RESEARCHES OF THE DEPARTMENT OF TERRESTRIAL MAGNETISM

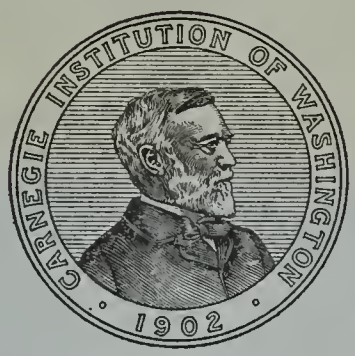
LAND MAGNETIC OBSERVATIONS

1905-1910

BY

L. A. BAUER

Director of the Department



WASHINGTON, D. C.

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Caravan in the Himalayas.

Hodeida, Arabia.

Near Woosung, China.

Cochrane River, Canada.

Tigris River.

Near Oroya, Peru.

Magdalena River, Colombia.

Sanju Pass, Himalayas.

Guam Island.

Near Mau Chau, China.

Near Kodaikanal, India.

Near Alexandria, Egypt.

Travel and Transportation Views of Land Magnetic Survey Expeditions.

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LAND MAGNETIC OBSERVATIONS, 1905-1910.

INTRODUCTION.

The present publication is the first of a series by the Department of Terrestrial Magnetism of the Carnegie Institution of Washington bearing the general title "Researches of the Department of Terrestrial Magnetism." Under this head it is proposed to publish the results of the various operations and researches conducted by this Department. While the subject treated will be chiefly that of the Earth's magnetism, from time to time memoirs will appear on other more or less closely allied subjects, such as atmospheric electricity, for example. The volumes on the work done aboard the magnetic survey vessels, the *Galilee*, 1905–08, and the *Carnegie*, 1909–, besides giving the results in terrestrial magnetism and atmospheric electricity, may set forth also the results of observations in atmospheric refraction, etc. In brief, certain volumes or portions of them may be on other subjects than terrestrial magnetism proper.

Each volume will have a subtitle setting forth briefly its special contents. Thus the present volume, "Land Magnetic Observations 1905–1910," contains the results of all magnetic observations made on land by the Department from the beginning of its observational work in February 1905 to the end of December 1910, practically six years' work. Future volumes will contain the land work subsequent to 1910, as also the observations made on the *Galilee*, 1905–08, and next on the *Carnegie*, 1909–.

The Department of Research in Terrestrial Magnetism was founded on April 1, 1904, one of its special objects being the acquirement of the necessary data for a general magnetic survey of the globe. The chief endeavor is to secure magnetic results in the regions where most needed and where there are no organizations prepared to undertake the work. Where magnetic surveys are in progress under competent direction and where the prospects for early completion are favorable, the Department confines its work to the observations necessary for the proper correlation of results obtained with different instruments and by different methods and renders such assistance to organizations as may be required. While the Department has been able to extend special aid at times to certain organizations, in order that their object might be effectively and expeditiously carried out, it is a pleasure to record and gratefully acknowledge here the cordial and valuable aid it has itself received from magnetic institutions in all parts of the world, as well as from the governmental and diplomatic representatives of the countries visited.

The publication of the results given in the present volume was necessarily delayed by the many problems presented when magnetic observations made over

the greater part of the globe are to be published on a uniform basis. Thus, in view of the differences exhibited among themselves by even well-constructed instruments, one of the problems was the determination of the corrections necessary for the reduction of the results to a common standard. The Department has now completed a variety of investigations on this subject and has others in progress. In the course of its work it has had opportunity to compare its instrumental standards with the chief ones of nearly every country. The preliminary results of these extensive intercomparisons will be found in the journal *Terrestrial Magnetism and Atmospheric Electricity*, vol. 16, pp. 61–84, pp. 137–162.

INSTRUMENTAL EQUIPMENT OF PARTIES.

MAGNETOMETERS.

The greater part of the present data has been obtained with magnetometers of the following types:

1. The so-called theodolite-magnetometer type in three designs, *viz.:* (*a*) that of the Department, similar to magnetometer No. 3, the particulars of which are given in Table 1; (*b*) that of the Department, similar to No. 13, and (*c*) that of the United States Coast and Geodetic Survey, similar to No. 20.
2. The Kew type of magnetometer in two designs, with auxiliary theodolites for astronomical work, *viz.:* (*a*) the regular design as constructed by Elliott Brothers, similar to No. 73, and (*b*) the Magnetic Survey of India design, similar to No. 36.
3. The light and portable type used in the Magnetic Survey of France, similar to No. 11.
4. The universal magnetometer type of the style designed by Eschenhagen and constructed with modifications by Tesdorpf, similar to No. 2025.

The theodolite-magnetometers of the first type (1), although of three patterns, are in many particulars similar in detail. The essential units of this type are four, *viz.:* (*a*) the base, center, and horizontal circle; (*b*) telescope standard frame; (*c*) telescope and vertical circle, and (*d*) magnetometer. In the first year's work of the Department, use was made, by the courtesy of the United States Coast and Geodetic Survey, of the standard magnetometers of that Bureau;[1] these are of the pattern (*c*). They were made in the instrument shop of the Survey and embodied the results of the extensive experience gained by its observers. The same base and horizontal circle serve for both the magnetometer and the theodolite attachments, thus making the instrument compact and portable without sacrifice in requisite accuracy. The brass deflection bar, while in two pieces, is so mounted as to insure invariability of the deflecting distances. The magnets are octagonal bars with the interior hollow and cylindrical; on the south end of the magnet is mounted a lens with a graduated scale, and on the north end is a collimating lens. The octagonal form of magnet, as also of stirrup, was adopted for convenience in inversion of magnet when determining the reading of the magnetic axis; for centering of magnet in the stirrup, a shallow groove is cut at the middle of the magnet,

[1] Hazard, D. L. Directions for magnetic measurements. *United States Coast and Geodetic Survey.* Washington, D. C. 1911. (53–55.)

which engages into a pin in the bottom of the stirrup. The suspension material is silk fiber; for the purpose of taking out torsion a brass bar equal in weight to the long magnet is used. In order to eliminate possible effects of impure brass, as also to prevent damping in oscillation work, the magnet houses are made of wood as far as possible. The details regarding these instruments are given in Table 1, page 8; this type is shown on Plate 2, Fig. 1.

Soon after the inauguration of the work of the Department, magnetometers of the first type (1) and style (*a*) were designed, combining the best features of the Coast and Geodetic Survey pattern and that of the Magnetic Survey of India. These are also portable instruments, and although somewhat heavier and larger than the Coast and Geodetic Survey instrument, because of increased detail, still between it and the Magnetic Survey of India[1] magnetometer in weight. To eliminate as far as possible questions arising because of irregularities in the shape of magnets, they are perfect hollow cylinders of such dimensions as to make the second distribution coefficient theoretically zero; they are inclosed in aluminum sheaths which carry the optical and centering arrangements. The graduated scale for declination work is not put in the focus of the collimating lens of the magnet as for the Coast and Geodetic Survey magnetometer above described, but on a glass diaphragm in the magnetometer telescope. The suspension used is a phosphor-bronze ribbon. The torsion is readily removed by a torsion plummet with graduated rim, read by a secondary lens which may be turned into the optical system of the magnetometer telescope. The deflection bar is of brass in one piece and practically rectangular in cross-section. The details of these instruments are given in Table 1, but it should also be noted that magnetometers Nos. 2, 3, and 4 were made some time before Nos. 5, 6, 7, 8, 9, and 10, and that as a result some of the purely mechanical details and dimensions were slightly altered. Plate 3, Fig. 1 shows this type of instrument.

The earlier land operations of the Department, especially in regions more or less difficult of access, having emphasized the need of more portable and more compact instrumental outfits than had been used, without sacrificing observational accuracy, the second style (*b*) of the first type (1) was designed.[2] The greater part of the work must be done in regions where travel is generally difficult and, accordingly, a bulky and heavy equipment constitutes a serious obstacle to safe and rapid transportation. The controlling conditions, therefore, in the designs by the Department, constructed in its instrument shop, were: (*a*) portability; (*b*) compactness; (*c*) simplicity; (*d*) minimum of separate parts; (*e*) readiness and availability for immediate use, and (*f*) the attainment of an observational accuracy equal to that of the best field instruments previously in use.

The magnet system for this instrument consists, as in type 1 (*a*), of a long and a short magnet, each a true cylinder of the dimensions given in Table 1; the ratio of the lengths of the two magnets is such as to eliminate theoretically the

[1] Fraser, H. A. D. The unifilar magnetometer of the Magnetic Survey of India. *Terrestrial Magnetism*, v. 6, 1901. (65–69.) See also Hazard, D. L., *l. c.* (59–60.)

[2] For a more detailed description of this type see Fleming, J. A. Two new types of magnetometers made by the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. *Terr. Mag.*, v. 16, 1911. (1–12.)

second distribution coefficient. The magnets are made of a special permanent magnet steel manufactured by the Crucible Steel Company of America, and the method of magnetization is substantially that given by Barus.[1] Each magnet is encased in a heavily gold-plated brass cylindrical sheath, which prevents rusting of magnet and provides means for mounting the collimating optical system, for balancing, and for centering magnet in the stirrup by a projecting pin in the bottom of the latter, the pin fitting snugly in a rectangular groove cut in the brass sheath. The weight of the long magnet with sheath is the same as that of the short magnet with its sheath. The reticle consists of two engraved intersecting lines at right angles on a piece of plano-parallel glass mounted at the south end of the sheath; hence, when using the magnetometer, the observer sights towards the magnetic south. The magnet may be placed quickly in position, "erect," or "inverted" with the aid of marks cut in the beveled edge of the stirrup. The entire suspension system is constructed as simply as possible; the devices for clamping the phosphor-bronze ribbon suspension have no removable parts and permit easy and rapid insertion of a new ribbon.

The ribbon now used ordinarily for the suspension is 0.010 by 0.127 mm. in section; that for inertia determinations is of a somewhat heavier grade. At Washington, where the horizontal intensity is about 0.20 C. G. S., the torsion for the lighter ribbon, for the suspension-length used, amounts to about 5 minutes of arc for 90° of twist. The total length of the suspension, *i. e.*, the distance from the bottom of the ribbon clamp at the suspension head to the center of the magnet when in place, is from 314 to 364 mm., depending upon the length of the ribbon between the upper and lower clamps; ordinarily the total length is about 340 mm. The graduated circle for the determination of the line of detorsion is permanently attached to the stirrup and brought into the focus of the reading telescope by interposing an auxiliary lens mounted at the telescope end of the magnetometer house and operated by a milled head. The angle of detorsion from the axis of the instrument may be quickly determined by noting the extreme swings on the graduation of the stirrup when the brass torsion weight, equal in weight to the long magnet as also of the short one, is suspended, and shifting the suspension head accordingly; this operation is repeated until the mean reading on the graduation of the stirrup is 180°, when the head is clamped in position.

The stirrup is of brass, heavily gold-plated to prevent oxidation, and of hollow rectangular cross-section, the width being made equal to the diameter of the magnet sheaths and the length sufficient to insure accurate orientation of the magnets. The height of the stirrup is such as to permit the mounting of an inertia bar, having the same diameter as that of the complete magnet, for the determination of the moment of inertia of the system. The stirrup may be easily raised or lowered by means of a rack and pinion arrangement operated by a milled head at the top of the suspension tube. As in the case of the magnetometer of the Magnetic Survey of India, there is provided an arrester for quieting the motion

[1] Barus, Carl. Effects of hardness on the electrical and magnetic constants of steel, with particular reference to the tempering of the magnetic parts of instruments. *Terrestrial Magnetism*, v. 2, 1897. (1–10.) Also, *Bulletin of the United States Geological Survey*, No. 14.

of the suspended magnet, although such an attachment is not deemed absolutely necessary by experienced observers who make use of the fingers instead. The distance from the top of the clamp of the stirrup to the center of the magnet when suspended is 35.5 mm., this being great enough to provide against any appreciable change in level of the suspended magnet for a large change in the value of the vertical component.

The scale by means of which the position of the collimation line of the magnet is referred to the horizontal circle setting, consists of 60 divisions engraved on the plano-parallel glass diaphragm of the magnetometer telescope. Particular attention has been paid to the engraving of these scales to insure accurate graduations and such suitably selected widths of the engraved lines as to permit of sharp definite readings and estimations—a point at times overlooked in instruments of otherwise excellent construction.

The deflection bar is of rectangular cross-section, 5 mm. thick and 15 mm. deep; it is mounted just below the magnet house and is centered and securely held in place by two slightly tapering pins, one at each side of the house. For centering and protecting the deflecting magnet against sudden changes of temperature, it is mounted in a specially constructed wooden box. The lower end of the magnet centering pin of the deflection box is finished so as to fit snugly in rectangular grooves in the deflection bar, thus insuring the invariability of the deflection distances. For maintaining the vertical plane of the center two broad arms extend down from the metal base of the box the full depth of the deflection bar, against which a heavy spring on the rear side presses them; a suitable counter-weight is suspended on the opposite side of the deflection bar to maintain the level of instrument during deflections.

The total weight of this type of instrument, with its case, is 11 kilograms; that of the type 1 (*a*) previously used by the Department is twice as much. When account is taken also of the much heavier shipping cases required for the older form the material reduction in total weight for transportation of the present instrument is made still more evident. In transportation the deflection bar is placed in a brass tube and packed or carried with the tripod; the weight of the tripod and bar is 4.25 kilograms, against 7.5 for the tripod and bar of the older form. This type of instrument is shown in Plate 3, Fig. 2.

The first Kew design (*a*) of the second type (2) is so well known to magneticians as to make unnecessary a detailed description.[1] The declination and deflecting magnet is a hollow steel cylinder fitted with a collimating lens and scale. The suspension material is silk fiber. The auxiliary or short magnet for use in deflections is also cylindrical, but the sighting arrangements are effected by means of a plane mirror, attached at right angles to the magnet, in which the image of an ivory scale is observed. The deflection bar is of brass, in one piece. In the earlier field work of the Department and pending the construction of its own design of instrument, use was made, in the magnetic survey of China, of instruments of this type

[1] For a more detailed and illustrated description see the article "Magnetometer" by William Watson in the *Encyclopædia Britannica*, eleventh edition, v. XVII (386–388). Also Stewart & Gee, *Practical Physics*, v. 2.

belonging to the Zi-ka-wei and to the Hongkong observatories. Also, for certain work in Africa executed for the Department by Professors Beattie and Morrison, use was made of two instruments of the Kew type, one the property of the London Royal Society, and the other of the Royal Observatory of the Cape of Good Hope. This style of instrument has no theodolite attachment but instead an "azimuth mirror"; since the use of the latter requires an accurate knowledge of the chronometer correction to local mean time, a matter presenting difficulties in unsurveyed regions and in exploratory work, separate theodolites were supplied for the astronomical portion of the observations.

Magnetometers 30 and 36, used during some of the earlier field work, are the property of the United States Coast and Geodetic Survey, and are substantially the Magnetic Survey of India pattern,[1] but without the vertical circle, except that 36 has the dimensions of the magnets so modified that theoretically the second distribution coefficient would be zero. This type is in a general way similar to the Kew pattern, except that a phosphor-bronze ribbon suspension is used in place of the silk fiber, and the short magnet is mounted in a stirrup above and parallel to an aluminum collimator similar in its optical arrangements to the long or deflecting magnet. For reading the lines of collimation of the magnets, instead of having a graduated scale mounted in the magnet, there is a graduated glass diaphragm in the reading telescope, while in the focus of the collimating lens of the magnet there is simply a plano-parallel glass with two lines engraved at right angles. In deflection work the deflecting magnet is protected against sudden changes of temperature by a wooden housing which, together with its centering arrangements and the magnet, may be shifted from distance to distance. The brass deflection bar is of one piece. This type of instrument is shown on Plate 2, Fig. 2.

Three magnetometers of the type 3, *viz.*, that of the Magnetic Survey of France, have been used: No. 11, constructed for the Department; No. 21, the property of the United States Coast and Geodetic Survey; and No. 24, the property of the Zi-ka-wei Observatory. A detailed description of this type is given by Mascart in his *Traité de Magnétisme Terrestre.*[2] This type is very light and has a telescope with vertical circle mounted eccentrically for astronomical observations, the magnet suspended by silk fiber in a brass house being central on the same base used for the astronomical work. The magnets are cylindrical steel bars of the dimensions given in Table 1. The optical arrangements consist of concave mirrors attached to the ends of the magnets, in the foci of which is a platinum scale, the reflection being read by means of the reading telescopes; in the case of the short magnet, by means of brass extension pieces mounted at the ends, the mirrors are placed in the same relative position as in the long magnet. The magnets are very light and with this type of instrument much trouble from variability of the torsion effect of the silk fiber suspension has been experienced. The type is shown on Plate 4, Fig. 1.

The only universal magnetometer used in the present work was that built after Eschenhagen's design, with some modifications, by Tesdorpf; it has the

[1] Fraser, H. A. D., *l. c.* Also Hazard, D. L., *l. c.* (59–60.)
[2] Mascart, E. *Traité de Magnétisme Terrestre.* Paris, 1900. (206–219.)

number 2025. This instrument was used only for a few stations in 1906 on islands in the Pacific Ocean; its loan was obtained through the courtesy of the authorities in charge of the Samoan Observatory. It is somewhat complex and intricate in construction. In the determination of the horizontal intensity, it was used as a relative instrument, the results being computed only from deflection observations; the relative constants and their changes with time were determined from observations at the Samoan Observatory before and after the field work, at Suva, Fiji, from intercomparisons with the *Galilee* party, and at the Christchurch Magnetic Observatory. As the deflection distances were not measured, no determinations of the distribution coefficients were made. The diameter of the horizontal circle is 12 cm., reading arrangements by microscopes being such that the least count is 0.2 minute; the diameter of the vertical circle is 10 cm. and least reading 1 minute. A complete description is given by Prof. K. Haussmann in the January number (1906) of the *Zeitschrift für Instrumentenkunde.*

In addition to the above enumerated magnetometers the Department has also at a few stations used magnetometer No. 8 of the United States Coast and Geodetic Survey. This instrument is one of the earlier styles used by the Survey, with cylindrical magnets, as manufactured by Jones of London, and is in a general way similar to the magnetometer of type 2, design (*a*), as described above.

Magnetometer No. 7041, used at Battle Harbor, Labrador, in 1905, was of the Bamberg type. A complete description of this instrument will be found in the journal *Terrestrial Magnetism*, v. 8. (130–143).

In the Table 1, on page 8, *C.I.W.* stands for Carnegie Institution of Washington (Department of Terrestrial Magnetism); d_1 and d_2, the inside and outside diameters, respectively, of the magnet referred to; Ph. Br. for phosphor-bronze suspension. The quantities refer throughout to C. G. S. units and the value of q is given for 1° C.

DIP CIRCLES.

The dip circles used have been of four patterns: (*a*) the regular Kew land pattern as made with slight variations by Dover and by Casella; (*b*) the Lloyd-Creak ship pattern as originally designed by Captain Ettrick W. Creak and made by Dover with some modifications introduced by the Coast and Geodetic Survey and by the Department according to L. A. Bauer's specifications; (*c*) the Brunner pattern of the Magnetic Survey of France as made by Chasselon, and (*d*) the pattern as designed by Eschenhagen and made by Tesdorpf as a part of his universal magnetometer. For the greater part of the work circles of the first and second patterns, (*a*) and (*b*), were used.

All of the Kew pattern instruments[1] used are essentially similar except in minor mechanical details and in the matter of the provision of horizontal or vertical agate supports and needle lifters, the former for observations in regions of high magnetic

[1] For more detailed descriptions see Stewart & Gee's Practical Physics, and the article by William Watson on "Inclinometer" in *Encyclopædia Britannica*, 11th Edition, v. 14. (354–355.)

TABLE 1.—*Details and Constants of Magnetometers Used.*

No.	Owner and maker	Type	Long magnet			Short magnet			Diameter horizontal circle	Suspension	Scale value for declination	Moments of long magnets at 20° C.		Deflection distances used	Distribution coefficients		Induction coefficient	Temperature coefficient
			Length	d_1	d_2	Length	d_1	d_2				Inertia	Magnetic		P	Q	h	q
			cm.	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*		′	*cgs*	*cgs*	*cm.*				
1	C. I. W.; Fauth & Co.[1]	1(c)	7.2	0.7	1.2	6.0	0.7	1.2	11.0	Silk	2.28	208	174	30, 40	− 1.90[4]	.....	0.0516	0.00066
2	C. I. W.; Bausch & Lomb[2]	1(a)	7.50	0.75	1.00	3.50	0.61	0.82	12.5	Ph. Br.	1.50	162	620	25, 27.5, 30, 35, 40	+15.78	−1000	0.0116	0.00035
3	C. I. W.; Bausch & Lomb[2]	1(a)	7.50	0.75	1.00	3.50	0.61	0.82	12.5	Ph. Br.	1.49	166	673	25, 27.5, 30, 35, 40	+10.71	+1000	0.0088	0.00041
4	C. I. W.; Bausch & Lomb[2]	1(a)	7.50	0.75	1.00	3.50	0.61	0.82	12.5	Ph. Br.	1.49	156	630	25, 27.5, 30, 35, 40	+14.87	− 881	0.0116	0.00035
5	C. I. W.; Bausch & Lomb[2]	1(a)	7.50	0.75	1.00	3.50	0.61	0.82	12.5	Ph. Br.	1.48	234	660	25, 27.5, 30, 35, 40	+14.59[5]	− 640[5]	0.0063	0.00046
6	C. I. W.; Bausch & Lomb[2]	1(a)	7.50	0.75	1.00	3.50	0.61	0.82	12.5	Ph. Br.	1.48	243	576	25, 27.5, 30, 35, 40	+13.61	− 361	0.0078	0.00046
7	C. I. W.; Bausch & Lomb[2]	1(a)	7.50	0.75	1.00	3.50	0.61	0.82	12.5	Ph. Br.	1.49	239	642	25, 27.5, 30, 35, 40	+16.51	−1277	0.0063	0.00048
8	C. I. W.; Bausch & Lomb[2]	1(a)	7.50	0.75	1.00	3.50	0.61	0.82	12.5	Ph. Br.	1.48	237	528	25, 27.5, 30, 35, 40	+14.67	+ 24	0.0063	0.00037
8CS	C. &. G. S.; Jones, London[2]	2(a)	8.56	....	0.76	7.73	....	0.76	15	Silk	2.70	127	248	24.4, 36.6 48.8	− 5.15	− 662	0.0142	0.00017
9	C. I. W.; Bausch & Lomb[2]	1(a)	7.50	0.75	1.00	3.50	0.61	0.82	12.5	Ph. Br.	1.48	240	516	25, 27.5, 30, 35, 40	+15.01	− 468	0.0078	0.00044
10	C. I. W.; Bausch & Lomb[2]	1(a)	7.50	0.75	1.00	3.50	0.61	0.82	12.5	Ph. Br.	1.50	238	620	25, 27.5, 30, 35, 40	+13.25	+ 490	0.0063	0.00035
11	C. I. W.; Berger & Sons[3]	3	6.2	....	0.45	3.1	....	0.45	10.1	Silk	...	28	185	15+, 20+	+ 8.14[4]	.....	0.0135	0.00040
												28	198	15+, 20+	+ 8.30[4]	.....	0.0095	0.00040
12	C. I. W.; Dept. Terr. Mag.[2]	1(b)	5.60	0.56	0.79	2.60	0.45	0.65	10.1	Ph. Br.	2.03	66	297	20, 25, 28	+11.00	− 871	0.0094	0.00047
13	C. I. W.; Dept. Terr. Mag.[2]	1(b)	5.60	0.56	0.79	2.60	0.45	0.65	10.1	Ph. Br.	2.05	66	284	20, 25, 28	+ 8.46	− 273	0.0101	0.00060
15	Met. S. Can.; Dept. T. M.[2]	1(b)	5.60	0.56	0.79	2.60	0.45	0.65	10.1	Ph. Br.	2.00	66	285	20, 25, 28	+ 7.29	+ 84	0.0104	0.00045
17	C. & G. S.; C. & G. S.[1]	1(c)	7.4	0.7	1.1	6.0	0.7	1.1	11.2	Silk	2.00	187	417	30, 40	− 1.24[4]	.....	0.0120	0.00047
19	C. & G. S.; C. & G. S.[1]	1(c)	7.4	0.7	1.1	6.0	0.7	1.1	11.2	Silk	2.00	188	359	30, 40	− 0.40[4]	.....	0.0130	0.00030
20	C. & G. S.; C. & G. S.[1]	1(c)	7.4	0.7	1.1	6.0	0.7	1.1	11.2	Silk	2.00	179	398	30, 40	− 0.96[4]	.....	0.0166	0.00048
21	C. & G. S.; Chasselon[3]	3	About as No. 11			About as No. 11			8	Silk	...	26	107	15+, 20−	+ 8.84[4]	.....	0.0060	0.00026
24	Zi-ka-wei; Chasselon[3]	3	About as No. 11			About as No. 11			8	Silk	...	26	146	15, 20	.....	.....	0.0103	0.00020
30	C. & G. S.; Cooke & Sons[2]	2(b)	9.27	0.76	1.02	6.35	0.52	0.70	13	Ph. Br.	1.37	255	882	22.5, 26.2, 30, 40	+10.78	−1346	0.0086	0.00040
31	Cape Town Obs'y; Elliott[2]	2(a)	9.25	0.70	1.00	7.00	0.39	0.74		Silk	2.20	295	704	25, 30, 35, 40	+ 9.68	−3086	0.0093	0.00071
36	C. & G. S.; Cooke & Sons[2]	2(b)	9.27	0.76	1.02	4.33	0.62	0.83	13	Ph. Br.	1.38	248	648	30, 40	+18.94	+ 511	0.0092	0.00041
49	Zi-ka-wei; Elliott[2]	2(a)	About as N o. 31			About as No. 31				Silk	1.83	286	708	30, 40	.....	.....	0.0080	0.00031
55	Hongkong Obs'y; Elliott.[2]	2(a)	About as No. 31			About as No. 31				Silk	1.84	285	567	30, 40	+ 8.03[4]	.....	0.0091	0.00026
68	Mass. Inst. Tech.; Elliott.[2]	2(a)	About as No. 73			About as No. 73				Silk	1.75	291	874	25, 30, 40	+ 8.58	+1174	0.0058	0.00042
73	Royal Society; Elliott.[2]	2(a)	9.25	0.71	1.00	6.4	0.40	0.76		Silk	1.75	302	690	25, 30 35, 40	+12.69	−2009	0.0073	0.00033

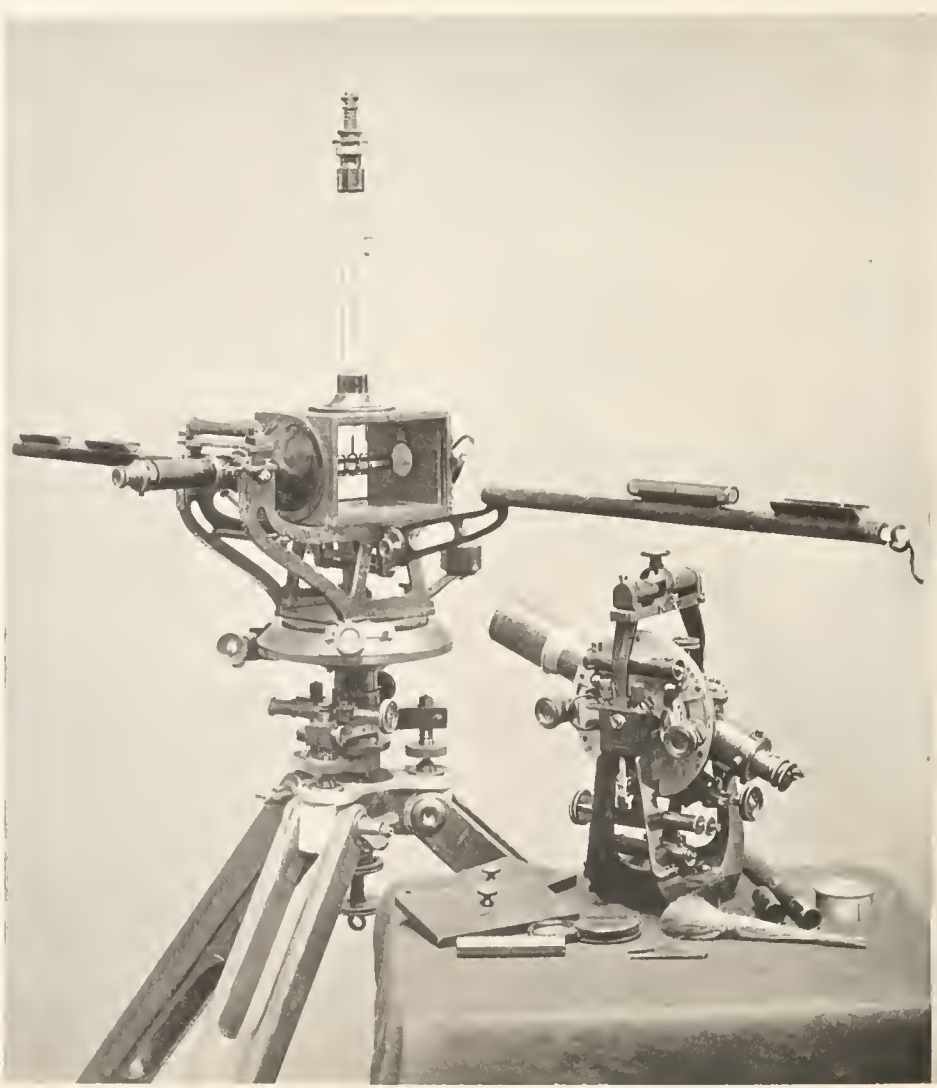
[1] The magnets are hollow steel bars with cross-section of octagonal periphery on the outside and circular on inside.

[2] The magnets are hollow cylinders.

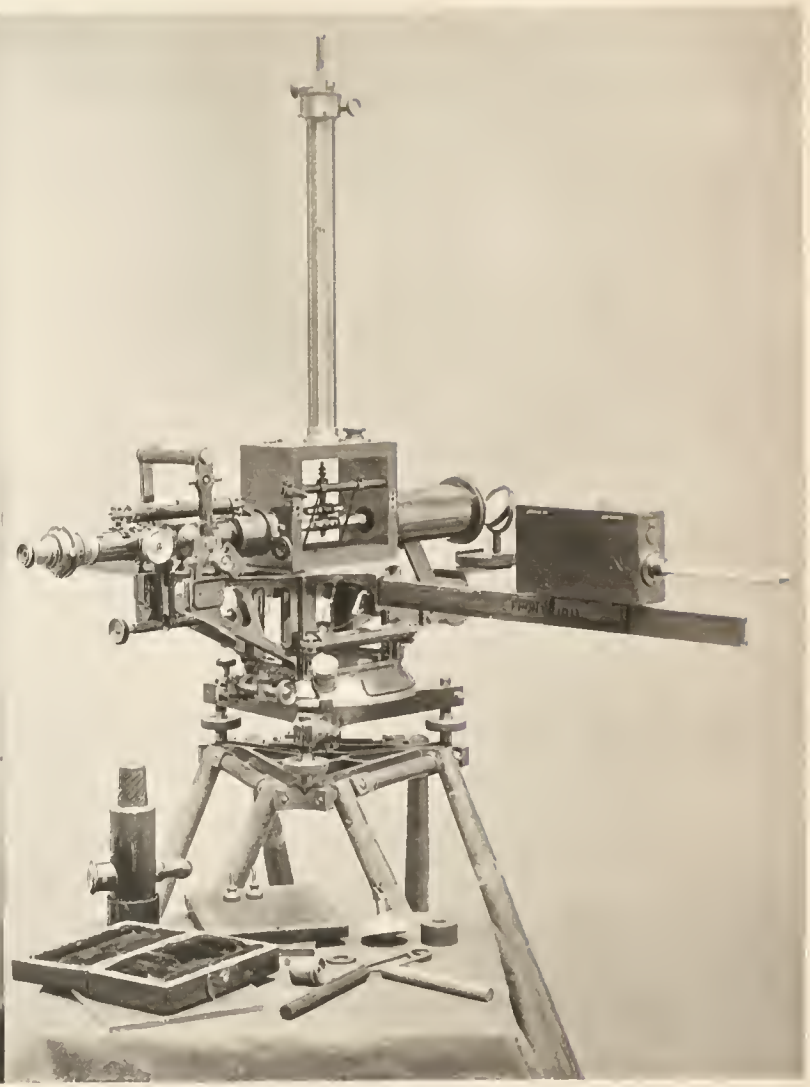
[3] The magnets are solid cylinders; long magnet system (No. 1) is marked by one dot on magnets; long magnet system (No. 2), by two dots on magnets.

[4] The values given under the heading P are values of P' assuming that $(1 + P'r^{-2}) = (1 + Pr^{-2} + Qr^{-4})$.

[5] Values used after the accident of March 28, 1910, are $P = +15.56$ and $Q = -570$.



1. U. S. Coast and Geodetic Survey Theodolite Magnetometer of type 1 (c).



2. Magnetic Survey of India Magnetometer of type 2 (b).

dip and the latter in regions of low magnetic dip. An instrument of recent construction by Dover is shown on Plate 4, Fig. 2. The diameters of the horizontal and vertical circles are each 12.5 cm., and the least count of the verniers is one minute of arc. As the result of our field experience in total intensity determinations, continuous graduation for both vertical and horizontal circles from zero through 360° instead of, as formerly, in four quadrants of 90° each, has been introduced in the newer instruments of the Department. This modification obviates the confusion which may arise when readings occur in various quadrants, as they actually do in the total intensity work. The length of needle used in the later instruments is 8.9 cm.; in some of the earlier instruments the needles are somewhat longer. The knife-edge agate supports are so adjusted that the axis of the axle of the suspended needle is as nearly as possible in the prolongation of the axis of the vertical circle bearing and center. Settings are made by sighting the ends of the needle with opposite microscopes so adjusted that their plane of collimation passes through the center of the vertical circle bearing, and may be read by two verniers 180° apart.

In the later instruments, a compass attachment, shown on Plate 4, Fig. 2, has been added both for obtaining approximate declinations and for use in setting the plane of the dip circle in the magnetic meridian. This attachment consists of a deep but thin needle with pivot suspension, mounted in a closed case with glass cover, at the ends of which are short graduated arcs, the zeros of these arcs being placed, as nearly as possible, in line with two sighting vanes and the pivot. The whole is arranged so that it may be quickly mounted centrally on the dip circle, the housing being clamped in place by two screw clamps. Settings are made on the thin, tapering ends of the needle by means of an ordinary lens, the observer being assisted in the avoidance of parallax by the depth of the needle.[1]

The modified Lloyd-Creak form of ship dip circle,[2] owing to lack of sufficient equipment, also had to be used in the earlier work. The order of accuracy attainable with it is somewhat less than with the regular land form. As this circle is designed for use on board ship, the knife edges of the land pattern are replaced by jewel cup bearings in which the pivots of the needle rest. The increased friction resulting from this form of mounting is overcome by tapping or rubbing, with an ivory scraper, a brass point on the top of the circle, thus imparting sufficient vibration to the needle and making it drop to the lowest point of the bearing. The needle, 11.35 cm. long, swings in the plane of the vertical circle, which is 11.4 cm. in diameter and is graduated to 10-minute intervals; the microscopes are similar to those of the land pattern except that with their aid the angular readings are made directly on the circle, the nearest minute of arc being estimated. In the later instruments the graduations of both the horizontal circle (diameter 12 cm.) and the vertical circle are numbered continuously through 360° for the same reasons as stated above for the land circle. This circle is also provided with a compass

[1] *Cf.* Bauer, L. A. Results of magnetic observations made by the Coast and Geodetic Survey between July 1, 1903, and June 30, 1904. Report 1904, *U. S. Coast and Geodetic Survey*, Washington, D. C. 1904. (196–197.)

[2] For detailed description see Bauer, L. A. Results of magnetic observations, &c., *l. c.* (192–194); also *Terrestrial Magnetism*, v. 11, 1906 (77–78), and v. 14, 1909 (164–169).

attachment very similar to that for the land circle; see Plate 5, Fig. 2, for a photograph of the instrument as modified.

In both patterns of dip circles provision is made for the determination of total intensity by Lloyd's method. To make the ship form available for the determination of total intensity over all parts of the earth, the original deflection distance was slightly increased and also a second, and longer, deflection distance was introduced. In some of the instruments a small astronomical telescope was added, so that, with the compass attachment, it could be used as a universal instrument for reconnaissance work when other instruments were not available.

Circles of pattern (*c*) are of the land type but differ in many respects from the Kew pattern. They are smaller, the horizontal and vertical circles being about 8 cm. in diameter; the least count of vernier is 1 minute of arc. The settings of the vertical circle are made by the use of reading lenses and concave mirrors mounted on the vertical circle, which rotates while the vernier is fixed. The needles are about 7 cm. long and swing on agate knife edges, as in the Kew circle. The housing is circular and of brass with glass sides, the upper half being removable to facilitate handling of the needles.[1]

Circle No. 2025, by Tesdorpf after Eschenhagen's design and made as a part of the universal magnetometer No. 2025 already described, was used by the Department for a short time during 1906. The diameter of the vertical circle is 11.4 cm.; the least graduation is 20′ of arc. Readings are made by estimation to the nearest minute of arc. The length of the needle is 11.5 cm. A complete and illustrated description of this pattern is given by Prof. K. Haussmann in the January 1906 number of the *Zeitschrift für Instrumentenkunde.*

A list of the various circles used, together with the needles and their designations, will be found in the notes under the heading of "Dip Circle Corrections to Standard," pp. 44–50.

EARTH INDUCTORS.

But two earth inductors have been used thus far by the Department, pending the completion of a design more suitable for field use than is the present one. These two inductors are designated as No. 48 and Department No. 2, the first being constructed by Schulze and the second by Toepfer & Son. They are both substantially of the design originated by Wild[2] and as modified by Eschenhagen. Plate 5, Fig. 1, shows No. 2. After the instrument is leveled the reading of the plane of the magnetic meridian on the horizontal circle may be determined by mounting a compass on the axles of the ring bearing the coil, the axis of coil being then clamped in this plane. The mean diameter of the coil is about 9.5 cm. and it is rotated by means of a flexible shaft as shown in the figure. Angular readings of the vertical circle may be estimated to 0.1 minute of arc by means of glass diaphragms divided into ten 1-minute graduations and mounted in the reading

[1] For an illustrated description of this instrument see Mascart, E., *Traité de Magnétisme Terrestre*, Paris, 1901. (214–215.)

[2] Wild, H. Inductions-Inclinatorium neuer Construction und Bestimmung der Absoluten Inclination mit demselben in Pawlowsk. St. Petersburg, *Mem. Ac. Sc.*, Ser. 7, v. 38, No. 3, 1891.

microscopes; the smallest graduation of the vertical circle is 10 minutes of arc and its diameter 15.5 cm. Suitable commutator arrangements are made and connections provided for wiring to the galvanometer; the latter may be made very sensitive by the use and adjustment of control magnets. The diameter of the horizontal circle is about 24 cm. and the graduation to whole degrees, while the least count of the vernier is 5 minutes of arc and settings may be made by estimation to one-half of this amount. Suitable levels are provided for the purpose of determining the relation of the axis of the coil when vertical to the line of sight of the microscopes, which are fixed in position. For a specimen showing the method of observation see page 41. In the case of No. 2 the vertical circle is protected entirely by a cover, while in No. 48 it is freely exposed; this modification was made by reason of the rapid tarnishing of the graduation which results after short use of the instrument when the graduation is exposed.

ACCESSORIES.

Each observer, besides being supplied with some form of the magnetic instruments already enumerated, is furnished with the following accessories: (*a*) a half-second pocket chronometer and three high-grade watches; (*b*) non-magnetic observing tent with cover, tripod stubs, and other appurtenances; and (*c*) miscellaneous accessories such as pocket compass, extra thermometers, aneroid, boiling point apparatus, measuring tape, camera, forms, etc.

The observing tent is of the pyramid type with two beams for spreading the canvas near the top, and one center pole which is in two pieces held together by a brass sleeve. The total height of the tent is 2.8 meters, the sides at the bottom when set up about 2.6 meters, while at the spreaders where the height above the ground is about 2 meters, the sides are reduced to 1 meter. To facilitate sightings on marks and for illumination purposes, the tents are provided on two sides with openings; they are set up with these open sides placed approximately in the magnetic meridian. In order that the center pole may not interfere with the instrument during observations, it is placed somewhat eccentrically as regards position of the tripod. Plate 8, Fig. 1, gives the general appearance of the tent when set up. Occasionally light-weight non-magnetic wall tents have been used, but on the whole the tent just described has been found preferable and is generally used, being considerably lighter and much more easily and quickly set up than the wall tent.

The additional camp, packing, and other temporary equipment which may be necessary is usually obtained locally by the observer according to his specific needs. To insure freedom from possible disturbing influences, the observer is in no case permitted to make use of a combined living and observing tent.

The items listed under (*c*) hardly call for description except perhaps in the case of the boiling-point apparatus used on some of the expeditions. The pattern is essentially that described and figured in the *British Antarctic Manual*, 1901, on page 94. It consists of a suitable copper boiler with a glass steam chamber, the thermometer being inserted in the latter and read entirely in the steam. An alcohol lamp is used for heating the water. The mercurial thermometers provided

for the land work for use with the boiling-point apparatus are graduated to 0.1° C. The length of the mercurial column for this graduation is about 1 mm., so that readings can be made by estimation to 0.01° C.

CARE OF INSTRUMENTS.

Each observer is held responsible for his entire instrumental equipment and upon delivery to him assures himself by careful and immediate examination that it is complete and in first-class order in every detail, not only as regards the instrument itself but also as to its miscellaneous accessories—watch oil, shellac, brush, adjusting pins, suspension material, glycerine, piece of chamois skin, pith, tissue paper, etc., etc. The outfit is also frequently examined in the field. A mental inventory and survey of each instrument case is made before leaving a station to make sure that no part is left behind; the habit of doing this is quickly acquired and frequently saves much worry and loss of time. At intervals of one or two months or less, depending upon the nature of the region traversed, the instruments are carefully cleaned and oiled with the highest grade of instrument or watch oil and put in good adjustment. In case of alterations involving changes in instrumental constants, etc., memoranda, with full particulars and dates, are at once made and transmitted to the Office. Accidents are reported promptly with full particulars as to damage; with the constant care exercised by the observers the number of accidents has been very low, even under the rough traveling conditions not infrequently experienced.

The magnets and needles of the various instruments are touched with the hands as little as possible and, after use or handling, are always wiped with a clean piece of chamois skin or with soft tissue paper; they are not allowed to touch each other nor come in contact with iron or steel objects, and are kept in such cases and positions as provided and indicated. The dip and intensity needles are wiped with tissue paper both before and after observations and the pivots and agate edges cleaned with pith. In reversing polarity of a dip needle the bar magnets are drawn smoothly from center to ends of needle, as nearly parallel to the axis of the needle as possible, and a sufficient number of strokes are taken to insure good magnetization; in general ten strokes have been found sufficient. The needles are remagnetized before beginning observations whenever some time has elapsed between sets or the instrument has undergone transportation. The poles of the intensity needles are, of course, never reversed and the weight in the loaded needle is not disturbed after the constants have been determined, except for very good reason.

The chronometer and watches require great care; they are carried in leather pockets close to the body, all possible precautions being taken to reduce jarring and jolting to a minimum; they are wound regularly at about the same time each day. Special care is exercised not to have any of the magnets near a timepiece, *e. g.*, in reversing polarity of dip needles, etc.

GENERAL METHODS OF WORK.

Selection and Description of Station.

The conditions to be satisfied in choosing a magnetic station are freedom from present and possible future local disturbances, and, as far as possible, convenience of access. Selections must be such that no electric railways, masses of iron or steel, buildings of stone or brick, or other known artificial sources of disturbance are near; in general it has been found that at least 1 kilometer from electric lines and about 0.2 kilometer from the other disturbing influences mentioned are safe distances for the usual field-work. When there is any doubt as to the existence of local disturbances, two intervisible points, 300 meters or more apart, are selected and the magnetic bearing of the line joining them is observed from both points; this may be done with the transit compass or with the dip-circle compass. If there is indication of local disturbance, another location is made and a test again applied, etc. When possible, stations are located on public property, or property belonging to an educational institution, because of greater probability of permanence of such locations.

In the case of old stations special effort is made to reoccupy the precise point if the local conditions permit; and if not, a new station is established. Sometimes, however, not only is a new station selected, but the old one also reoccupied; the old station, while not satisfying the requirements of future availability, may still suffice for determining the secular variation; in such a case sufficient observations are made to effect a good transfer from the old to the new site. Secondary or auxiliary stations, such as are required, for example, in the intercomparison work, are, in general, located on a line of known azimuth from the primary station.

Every station occupied is described, whenever possible, with sufficient detail to permit its ready recovery. Photographic views are taken whenever possible and a sketch is made of the station with its surrounding objects, and measured distances to nearby objects are given. Particular care is exercised in the spelling of geographical names, especially so with regard to names of places in comparatively unexplored countries, where much of the work of the Department must be done; the adopted spelling is usually that most commonly used locally.

The station is marked in as permanent a manner as local conditions permit. The most desirable form of marking is by means of a non-magnetic stone monument, a drill hole in the top, 1 or 2 cm. deep, serving to indicate the precise point; these markers are set sufficiently deep in the ground to be free from frost effects, as also to prevent ready removal by unauthorized persons. Where convenient, the top of the marker is lettered or numbered, for example, thus:

C I
19○09
W

In case a stone post can not be procured, a wood post set firmly in the ground may be used or a mark may be cut in a surface stone. In general, however, only such stations as give promise of permanency are marked in some durable manner.

ASTRONOMICAL WORK.

The observations at each station are of two classes, astronomical and magnetic; from the first are obtained the true azimuths of marks used in the magnetic work, correction of chronometers on local mean time and the geographical position; the second embraces the determination of the three magnetic elements: declination, dip, and intensity. In order to secure the necessary stability, the tripods on which the instruments are mounted are made to rest upon three oak brass-bound stubs, about 20 cm. long, driven well into the ground.

In general, observations for latitude, time, and azimuth are made preferably on the Sun; only occasionally are they made on stars and planets, night work being usually attended with various inconveniences.

The *theodolite* is used either as an attachment or a part of the magnetometer, as in the so-called theodolite-magnetometer and in the universal magnetometer, or is an entirely separate instrument. On the diaphragm of the telescope is ruled a single cross formed of one vertical line and one horizontal line. The graduated horizontal and vertical circles are in general about 10 or 12 cm. in diameter, and the least count of the verniers is from 20 to 60 seconds of arc. The instruments are carefully constructed and the degree of accuracy aimed at in their design is of the order of 30 seconds or less. For the purpose of carrying time, the observer is usually provided with a half-second pocket chronometer and two or three watches, these timepieces being intercompared daily and handled with every care.

Chronometer record.—As often as possible the chronometer and watch corrections on standard time are obtained by means of previously arranged telegraphic time-signals. Corrections to standard meridian time are also obtained from the alt-azimuth observations or from special time observations at stations of known longitude. Advantage is likewise taken of opportunities to secure comparisons with ship chronometers, a statement being made as to the reliability of the time furnished. Determinations of chronometer or watch rates are made whenever opportunity permits repeated time observations at the same station or when a previously occupied station, in the course of travel, is again reached; such determinations, with an interval of not less than three or four days, are always of value. Daily intercomparisons between chronometers and watches (referring all to same chronometer time) are made and record is kept with pertinent notes as to conditions of travel, remarks as to winding, failure to wind, etc. The comparisons are made in general twice daily, including intervals of rest or delay as well as when traveling and when at stations; so far as is possible, these intercomparisons are made, from day to day, at approximately the same chronometer time morning and evening. These records and comparisons, as well as signals, are kept according to civil reckoning, counting hours from zero (midnight) through 24 hours. In connection with signals or chronometer comparisons, the records kept by the observer show all necessary particulars.

By "correction to standard" is meant the quantity which must be applied to chronometer or watch time to get the standard meridian time; the correction is thus always positive when the timepiece is slow and negative when fast, and

accordingly a losing rate is indicated by a positive sign and a gaining rate by a negative sign. In the office computations for longitude, all of the timepieces carried are used in the determination of the finally adopted correction of the chronometer to Greenwich mean time.

The observations for *azimuth* and *time*, whenever possible, consist of both morning and afternoon alt-azimuth observations on the Sun at about the same hour-angles, preferably not less than 2 hours from apparent noon. When the readings on mark for vertical circle right and left have been taken, the usual order of pointings on the Sun is as follows: beginning with vertical circle left, two successive pointings on the Sun bringing two of its limbs tangent to the diaphragm cross-lines in the quadrant, chosen so that the Sun apparently moves off one line and across the other; next two successive pointings on the Sun in the opposite quadrant with vertical circle reversed or right; for each pointing are recorded the chronometer time, horizontal circle reading vernier A and vernier B, vertical circle reading vernier A and vernier B, this completing one set. After any developed difference in level has been corrected, the second set is made in the reverse order of position and pointing to that of the first, making sights 5 and 6 same as 3 and 4, and 7 and 8 same as 1 and 2, concluding with mark readings, vertical circle left and right. Under the proper headings as shown in the specimen observation on p. 32, there are entered the precise mark used, position of the vertical circle, whether on left hand (L) or on right hand (R) side, when sighting on object from eyepiece end of telescope, and the apparent limb of the Sun observed upon.

The *latitude* is usually determined from circummeridian altitudes of the Sun, beginning about 10 minutes before and continuing about 10 minutes after local mean noon. The pointings are made on the upper and lower limbs of the Sun in pairs, the position of vertical circle being shown in specimen on p. 31.

Weather conditions, or other considerations, may not always permit strict adherence to the above scheme of astronomical work, and the question as to the desirability of spending additional time may, in consequence, arise; remaining at one station for any length of time may occasion considerable additional expense and subsequent delay. The relation of error in azimuth to the error in latitude is expressed by $dA = -\cot t \sec \phi \, d\phi$; it is thus seen that with nearly equal hour angles, *i. e.*, if for morning and afternoon observations the altitudes are nearly equal, the resulting mean value of the azimuth is almost free from error due to the use of an erroneous latitude as derived, for example, from a map. Hence it may not always be worth while for an observer to remain at a station until he has secured a regular set of latitude observations, especially as the latitude generally obtainable from maps suffices for the prime purposes of the work. Sometimes it is possible to obtain only a morning or an afternoon set of azimuth observations in addition to the latitude observations; in this case also the observer is not required to wait over for a second azimuth determination. Sometimes but one or two exmeridian pointings on the Sun for latitude observations can be obtained: these will generally furnish a sufficiently good determination if they are made within 20 minutes of local apparent noon.

When, on account of clouds, there is prospect of difficulty in securing pointings on the Sun, the order of observation is modified as may be necessary; thus, for example, instead of making two pointings, vertical circle left, the instrument is immediately reversed after the first pointing and another secured in the opposite quadrant. In cases where only one pointing was obtained, the observer determines the horizontal and the vertical collimation of his instrument, by proper readings on a mark; thus the necessary corrections may be applied. When the Sun is partly overcast, or when it must be sighted through the branches of trees, the desired quadrant can not always be selected and the one available must be used, proper record being made, of course, of the apparent limb observed; sometimes the same limb must be taken on reversal. Occasionally in cloudy weather during the day, the nights are clear, and sometimes in an emergency delay may be avoided by observing a planet or a star, for azimuth and latitude. In general, however, the observers are instructed to avoid observational work by night except in emergency or when they have special facilities.

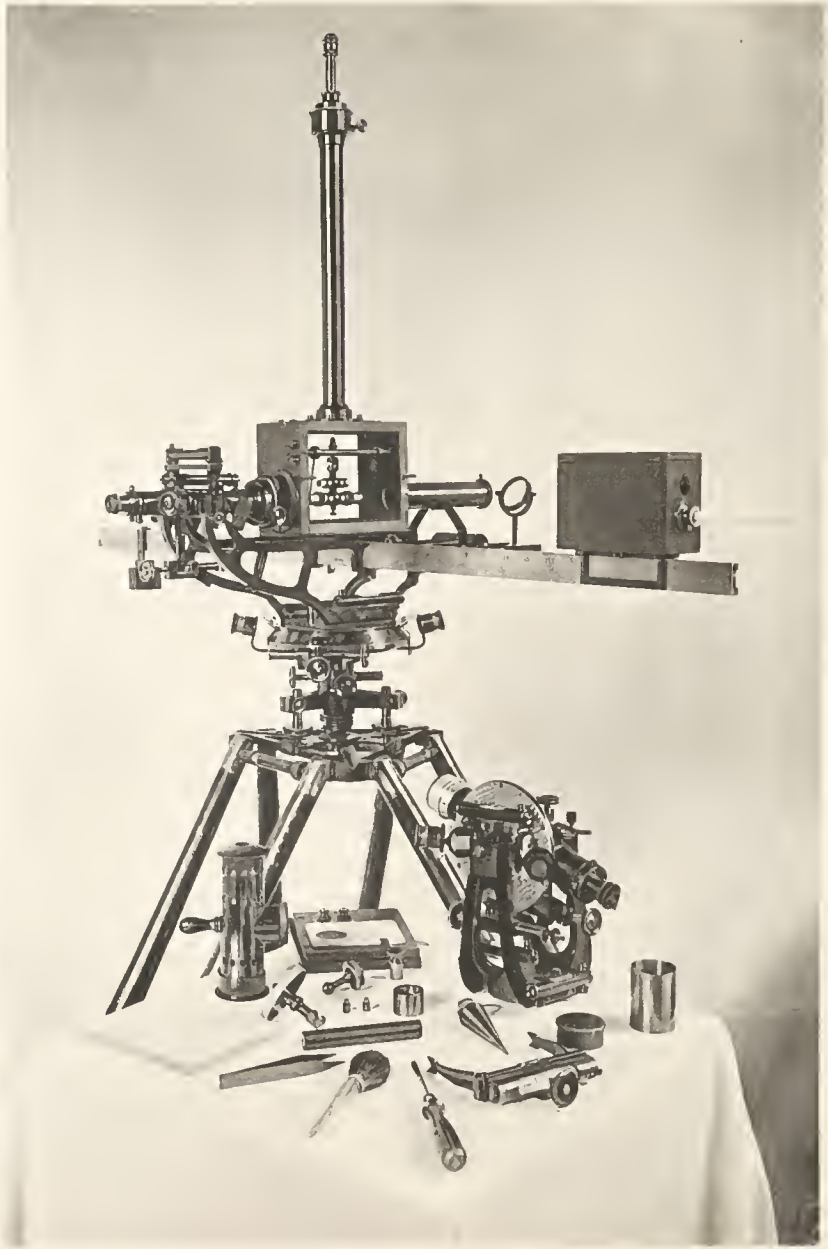
Measurements of angles between prominent marks, reference points, etc., are required where marks and reference points are available. In recording angular measures on a series of marks the record indicates whether these readings precede or follow the Sun work: the readings are invariably made forward and then back with instrument reversed, in the reverse order, and so recorded, thus: $1L$, $2L$, $3L$, etc., to nL, then nR, $(n-1)R$, etc., to $2R$, $1R$.

MAGNETIC WORK.

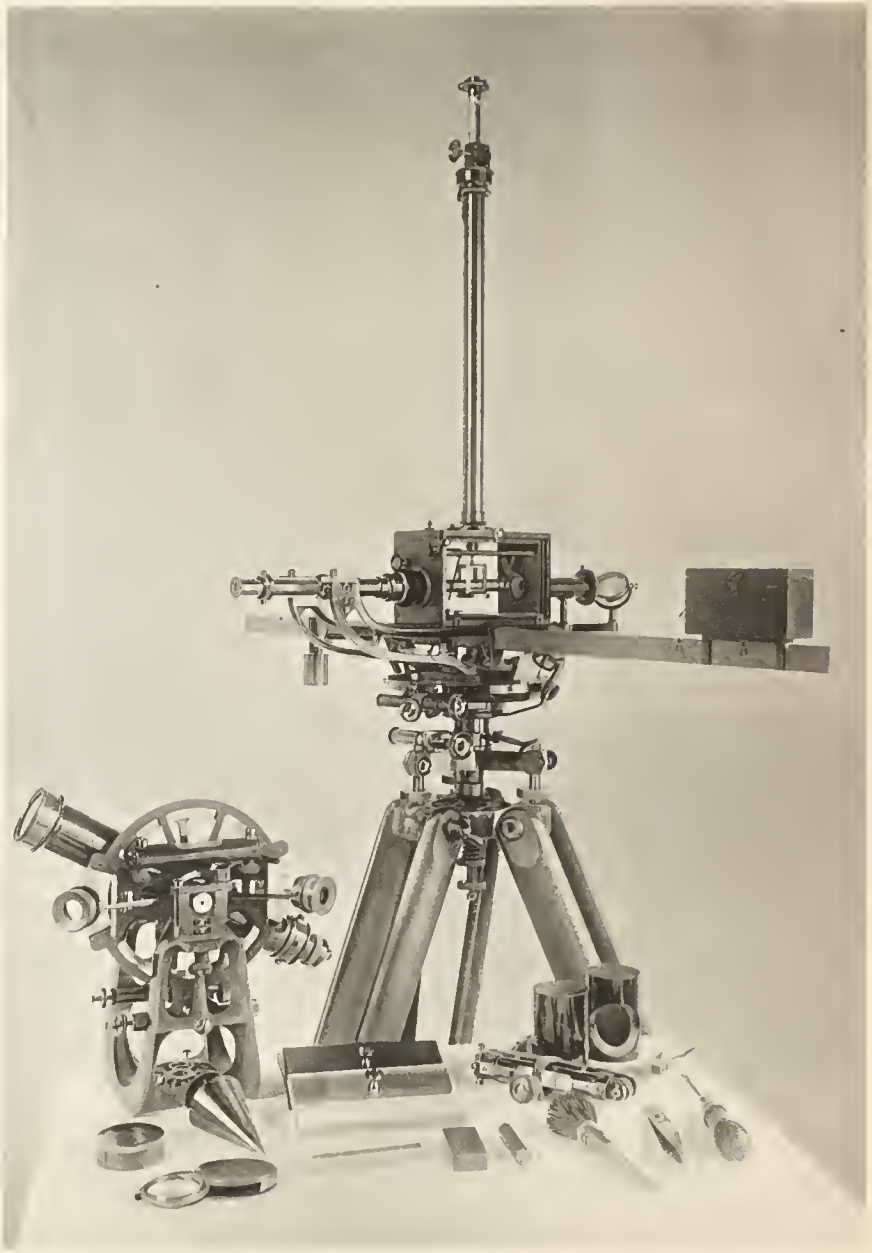
Magnetometer observations.—A complete set of magnetometer observations at a station comprises (*a*) declination; (*b*) oscillations of magnet erect, not less than 10 differences of 50 or more oscillations, generally more, the initial arc of vibration being, in general, not over 1.5°, so as to render the correction on account of amplitude of swing negligible; (*c*) deflections, both magnets erect, at two deflection distances; (*d*) deflections, both magnets inverted, if construction permits, at two deflecting distances; (*e*) oscillations of magnet inverted, not less than 10 differences of 50 oscillations, generally more; (*f*) declination.

Determination of the torsion coefficient is made at least once at each station. Except for good reason, *e. g.*, necessity of embracing, on cloudy days, an opportunity afforded for astronomical observations, the corresponding observations of oscillations and deflections are separated by the shortest possible interval. The same thermometer is used throughout the intensity observations, being mounted in the magnet-house during oscillations and in the deflection-box during deflections; in deflection work the first temperature is noted at the end of the half set in order to allow the thermometer time to take up temperature of bar; if temperature is changing rapidly it is read at the beginning as well as the end. Care is always taken to stop up the thermometer hole in the magnet-house when the thermometer is removed.

A single *declination* value by magnetometer results from the mean of two scale-readings (magnet erect), four (magnet inverted), and two (magnet erect), together



1. Carnegie Institution of Washington Theodolite Magnetometer of type 1 (a).



2. Carnegie Institution of Washington Theodolite Magnetometer of type 1 (b).

with the necessary mark and circle readings before and after the observation for the reference of the magnetic meridian to the astronomical meridian. The plane of detorsion of the suspension is of course first carefully determined and made to coincide with the vertical plane through the collimation axis of the instrument. A complete specimen set is given on page 37.

From the mean circle readings for each distance in the deflection observations and from the fact that the deflecting magnet is inverted during the second set, a value of the magnetic south meridian is obtained which, in connection with mark readings made before and after the observations, may be used in deriving an approximate value of the magnetic declination. Such values must be corrected, however, for index and collimation error as determined by comparisons with the standard magnetometer. The data derived thus are used only where, for some reason, the regular declination observations were either not obtained at all or appear defective.

The attempt is made to eliminate instrumental errors, as far as possible, by different orientations of the instrument for the various sets obtained, *e. g.*, different orientations of footscrews, thus causing readings to fall on different parts of the circle, etc. This is also the case with regard to the dip circle.

Dip circle observations.—The usual dip circle observations comprise (*a*) declination by compass attachment, from which also for ordinary latitudes the magnetic meridian reading for dip work is at once obtained; (*b*) dip with two or more needles (in the order of observation: polarity *A* north, needle No. 1, polarity *A* north, needle No. 2, etc., reversal of polarities of the needles, observations of polarity *B* north, in the reverse order of the needles used; the mean results will thus apply practically to the same mean time). In addition, the following dip circle observations are made whenever there is no magnetometer equipment available, or when, as is the case in high magnetic latitudes, the usual horizontal intensity observations present difficulties and the intensity work, in consequence, either requires strengthening or must be confined wholly to total intensity determinations: (*c*) loaded dip; (*d*) deflections with suspended needle "direct" or face of needle towards face of vertical circle or of observer; (*e*) deflections with suspended needle "reversed," or face of needle away from that of vertical circle; (*f*) loaded dip. In the case of an instrument provided with two deflecting distances deflections are obtained for suspended needle both direct and reversed for each distance, with a loaded dip observation between deflections for the two distances.

Care is always exercised that the deflecting needle is invariably mounted in the same relative position to its case. For land work in regions where the dip is from 0° to ±75° and where the equipment includes a magnetometer, the total intensity observations are not made except when, for some reason, specially prescribed. See specimen observations, pp. 36 and 38–39.

A single set of declination observations with the compass attachment of the dip circle comprises the following: (*a*) mark readings with peep sights (or with telescope if one is provided), direct and reversed position of instrument, the needle being clamped during this operation; (*b*) the needle released and examined to see

that it swings freely, after which, when the amplitude has been sufficiently reduced, a setting of north end of needle is made on the zero of the graduated arc of the compass box and the horizontal circle read; a similar setting and reading of horizontal circle for south end of needle; after lifting needle and letting it down gently, settings and readings in reversed order, *viz.*, south end, then north end, thus comprising four circle readings; (*c*) four settings and readings in the order as before, making the north end stand at the 5° east mark of the graduated arc and the south end at 5° west; (*d*) four settings and readings, north end 5° west and south end 5° east; (*e*) four settings and readings same as (*b*); (*f*) finally, mark readings in reversed order to (*a*). Throughout the needle settings, the needle is preferably kept in slight vibration and every care is taken to detect any sticking or irregularity of swing, thus revealing injury to pivot or to jewel bearing. Additional sets are obtained as conditions permit. See specimen form of observations and of computations, p. 40.

Earth inductor observations.—A single set after the rotation axis of the coil has been oriented in the magnetic meridian by means of a compass needle consists of: (*a*) vertical circle reading when axis of coil is vertical as shown by attached level direct and reversed; (*b*) vertical circle reading for circle east and righthand rotation of coil, of line of inclination, *viz.*, position of axis of coil when no current is produced and galvanometer shows, hence, no deflection; (*c*) repetition of (*b*); (*d*) repeating (*b*) for lefthand rotation of coil; (*e*) repetition of (*d*); (*f*) four settings with readings made as before except that vertical circle is west; (*g*) same as (*a*). For specimen set of observations and of computation, see p. 41.

DIURNAL VARIATION AND MAGNETIC PERTURBATIONS.

In order to eliminate the error due to uncertainty of the diurnal variation correction, the declination observations are made at various times of the day, whenever conditions will permit. In ordinary latitudes, declination observations made about 10 to 11 a. m. or between 4 and 6 p. m. (local time) will correspond fairly closely with the average for the day (24 hours); so will likewise the mean of observations made between 7 to 9 a. m. and 12 to 2 p. m. Local disturbances frequently exceed the diurnal variation correction; hence, in disturbed regions and if the time be limited, multiplicity of stations rather than great accuracy at one station must be the endeavor. Occasionally, once every two or three months, diurnal variation observations are made in the field by taking 5-minute declination readings throughout the day; these will be used, together with observatory data, in the reduction to mean of day or month. For diurnal variation correction in inclination or in intensity, reliance must be placed upon the data being obtained by the existing observatories. In general, except during magnetic storms, the diurnal variation corrections for the latter elements are on the order of the error of observation.

When the observations give indication of pronounced magnetic perturbations, correction on account of which would be difficult to determine with certainty from the available observatory data, the best course is to reject them entirely. Accord-

ing to the methods followed whereby the observer is obliged to make a preliminary reduction before leaving a station, he can himself detect such cases if he has not already done so while observing; he will then, before departure, make another series of observations.

Intercomparisons of Magnetic Instruments.

Stations.—When the preliminary arrangements have been made, tests are carried out to determine whether, at the proposed site for the intercomparisons, any pronounced local magnetic disturbance exists. If so, and another site for any reason can not be chosen, particular care is exercised to see that, at the same station, the magnetic systems of the various instruments are in the same horizontal plane. In case this procedure is not possible, the height of magnet from a suitable reference point, *e. g.*, from the top of a stake driven into the ground, is noted and determinations are made at each station to find the necessary corrections for the various levels in which the intercomparisons had to be made. Whenever possible, disturbed sites are avoided, but this can not always be done, as for example, in the ocean work where islands often afford the only opportunity for intercomparisons. An entirely undisturbed island is not of frequent occurrence.

Generally but two stations are required, which, unless already named, as may be the case at observatories, are designated, *A*, *B*. For observatory work *B* is the auxiliary station and *A* the regular observing pier; at some observatories different piers or stations are used for the various elements and intercomparisons for each particular element must be made accordingly. The azimuth lines for both stations are preferably referred to the same determination of azimuth, in particular, when no exchange of stations can be effected. Where possible both stations are placed in the same azimuth line and the same mark is used at both stations, thus assisting in the avoidance of extraneous error. Triangulation between stations for azimuths of marks is resorted to only when absolutely necessary. In cases where it is not feasible to use the regular observatory piers, a second auxiliary station is established in accordance with the directions already given.

Method of observations.—To secure reliable results expeditiously simultaneous observations with the instruments being compared are preferred, as also an exchange of stations; in this way any possible station difference may be eliminated and the desired instrumental difference be derived without recourse to auxiliary instruments, *e. g.*, magnetographs. At observatories where the same piers used in determining the magnetograph base lines may be utilized and the required magnetogram data be obtained promptly, there may be no necessity for an exchange of stations and simultaneity of observations, though this is found, in general, to be the better procedure. When tripods must be used, each instrument is mounted each time on its own tripod. When, for some reason, simultaneous observations are not possible, the observations are carried out alternately at each station by the same observer, thus, with the two instruments 1 and 2, and the stations *A* and *B:* observations with 1 at *A*, with 2 at *B;* 2 at *B*, 1 at *A;* 1 at *A*, 2 at *B;* 2 at *B*, 1 at *A;* and so on; next, 2 at *A*, 1 at *B;* 1 at *B*, 2 at *A;* 2 at *A*, 1 at *B;* 1 at *B*, 2 at *A;*

and so on. As little time as possible is allowed between determinations at the two stations in order to minimize outstanding effects of corrections to common epoch. With the number of determinations called for, this scheme of observation, while of course not as good as simultaneous intercomparisons, can, with care, yield results of value.

Whenever possible, the practice is to secure with each instrument at least twelve complete determinations of declination, six at each station; six complete determinations of horizontal intensity, three at each station (one determination consisting of two sets of oscillations and two sets of deflections at two distances); and at least six determinations of dip with each needle, three at each station. The observations are made for different orientations of the footscrews of the instruments, preferably such that there will be an equal number of observations at each station for footscrew marked *A* south, footscrew *B* south, footscrew *C* south. The work for any one element is not completed on one day but distributed over several days in order to minimize possible effect due to magnetic perturbations. Where an exchange of stations is not practicable, the total number of determinations for each element is at least as great as just stated.

Particular care is used to see that the instruments are in good working order and the requisite caution is exercised to insure the absence of disturbing influences of whatever character. Before leaving the station, the computations are completed far enough to make sure, at least, that no observational blunders have been made.

FIELD RECORDS AND COMPUTATIONS.

Records.—The observations are recorded with a hard pencil (No. 4 grade in the temperate and arctic regions, and No. 3 grade in the tropic regions) and entered at once on the proper form, not kept on blank paper and afterwards copied on the form. All computations are made in ink or inked over before the record is sent to the Office. The various sheets, arranged in the following order, are fastened together in the covers provided: (*a*) description of station; (*b*) sketch; (*c*) information as to chronometer comparisons and corrections on standard time; (*d*) latitude observations and computations; (*e*) azimuth and time observations and measurements of angles; (*f*) azimuth and time computations; (*g*) magnetometer declination; (*h*) dip circle compass declination; (*i*) oscillations; (*j*) deflections; (*k*) dip observations; (*l*) dip circle intensity observations; (*m*) summary sheet. When working in regions where the dip is within a few degrees of zero, particular care is taken both in the correct designation of which end of the needle is the north-seeking one, and in entering readings under properly headed columns for north and south ends.

The records are sent to the Office whenever a safe means of transportation offers. First, however, the observer makes an *abstract* containing such observational means and quantities as would be required for recomputation in case the original records were lost in transmission to the Office. The various observation sheets invariably give the day of the week in addition to that of month and year, thus: Mon. Nov. 15,

1909, and not simply Nov. 15, 1909, in this way providing a check against blunders in recording dates. Information concerning conditions under which observations are made, both as regards the observer and his surroundings, are always found useful by the office computer and are given under "Remarks" on the respective sheets. Specimen records of observations are given in a subsequent section.

Computations.—Before leaving a station, the observer carries the computations far enough to make sure that there is nothing radically wrong with the observations. Thus, in general, for good work two consecutive sets of azimuth should agree within 1 minute of arc, and morning and afternoon sets within 2 minutes of arc; greater differences are usually due to lack of adjustment or level of the theodolite, to a blunder in pointing on wrong limb of the Sun, or to erroneous value of latitude. In case the difference between morning and afternoon azimuth amounts to more than 5 minutes, the observations are repeated. The two sets of declination should not differ more than 2 or 3 minutes when approximate allowance is made for diurnal variation. The average mean time of 70, 100, or whatever number of oscillations is used, should in general not differ more than 0.5 second in the two sets and the deflection angles should in general agree in the two sets within 0.5 minute of arc for the short distance and 0.25 minute of arc for the long distance; these limits, however, depend on the instrument used. The attempt is to secure an accuracy of at least one-thousandth part of the value of the magnetic horizontal intensity. If the dip results for the individual needles, when reduced to standard, differ much over 2 minutes from each other, the observations are repeated.

The observers soon acquire the practice of carrying out observational means as the observations progress, thus making possible the immediate detection and correction of blunders. When for some good reason the computations can not be made before the observer must go to his next station, a close inspection of his observational means generally suffices to indicate whether or not the observations are satisfactory; for example, a close scrutiny of the means as called for on the azimuth forms will point out erroneous work.

In general, five-place logarithms are used in the reductions. For the azimuth computations, the means of circle readings are carried to tenths of minute of arc, the times to tenths of seconds; in the time computations, the hour angle in arc is taken out to whole seconds. In the declination reductions, the mean scale readings are carried to hundredths of a scale division, and the balance of the computation to tenths of minute of arc. For the intensity work by the magnetometer, the mean time of one oscillation is computed generally to four decimal places, the mean temperature to hundredths of a degree, and deflection angles to the nearest second of arc. The dip computations are carried to tenths of a minute of arc. The local mean times are computed to the nearest minute.

Reports.—Each observer, in addition to making a brief monthly report of his operations, upon the completion of a field campaign, makes a report on the work executed, covering all matters of interest and containing information and suggestions for guidance in future expeditions.

REDUCTION FORMULÆ AND DETERMINATION OF CONSTANTS.

Astronomical Work.

The *latitude*, as already described in the previous section, is usually determined from circummeridian altitudes of the Sun. In the field, the observer uses for his preliminary computations of azimuth and time the latitude as derived from the maximum observed altitude. The circummeridian reductions, as shown in the specimen computation on page 31, are made at the office according to the formula:

$$h_0 = h + Am + Bn + \ldots$$

where h_0 = meridian altitude, h = observed altitude at the hour angle t,

$$A = \cos\delta \cos\phi \csc\zeta_0 \qquad B = A^2 \cot\zeta_0$$

$$m = \frac{2 \sin^2 \frac{1}{2}t}{\sin 1'} \qquad n = \frac{2 \sin^4 \frac{1}{2}t}{\sin 1'}$$

δ = meridian declination of the Sun or star $\qquad \phi$ = latitude

ζ_0 = meridian zenith distance of Sun or star.[1]

These formulæ are not exact and must therefore be used within limits; in general, the greatest value of t in minutes of time should not exceed one-half of zenith distance in degrees. For an accuracy of 0′.05, and for values of the meridian zenith distance not less than 10°, the correction terms other than the first are negligible within the limits given. For the computation of A, the approximate value of latitude is usually sufficient.

Outside of the stated limits, when the zenith distance is less than 10°, as is frequently the case in the tropics, the following exact formula is used in the office reductions:

$$\sin \tfrac{1}{2}(h_0 - h) = \frac{\cos\phi \cos\delta \sin^2 \frac{1}{2}t}{\cos \frac{1}{2}(h_0 + h)}$$

Here t is as determined from the first reductions of time and azimuth.[2] This reduction involves the assumption of the latitude for the first approximation to the true value of the latitude; a second approximation is then made, using the value so determined, and the operation is repeated until the assumed and computed values agree. The formula does not give a very rapid approximation, but experienced computers rarely have to make more than a second or third approximation.

Azimuth and Time Computations.—See specimen, pp. 32, 33. The zero of the circle graduation having been referred to some terrestrial mark by sights before and after the Sun work, the true azimuth of mark is determined from the computed azimuths of the Sun for each mean time of observation by the formula:

$$\cot^2 \tfrac{1}{2}A = \sec s \sec(s - p) \sin(s - h) \sin(s - \phi)$$

where A = Sun's azimuth reckoned from the south to the east for a. m. observations and to the west for p. m. work; h = mean observed altitude corrected for refraction and parallax, ϕ = latitude, p = Sun's polar distance at the time of

[1] Chauvenet, W. A manual of practical and spherical astronomy. Philadelphia. 1885, v. I. (235–250.)
[2] *Idem*, pp. 234 and 235.

observation, reckoned from the North Pole, and $s = \frac{1}{2}(h + \phi + p)$. North latitudes and north declinations of the Sun are to be given the plus sign; south latitudes and south declinations will then have the minus sign. The determination of the local apparent hour angle, t, results from the formula:

$$\tan \tfrac{1}{2}t = \frac{\sec (s - p) \sin (s - h)}{\cot \tfrac{1}{2}A}$$

Converting the derived value of t into time and applying E, the equation of time, the local mean time of the observation set is obtained, whereas the mean standard time results from the mean chronometer time corrected with the aid of the data given in the chronometer record. From the difference between standard time and local mean time, the difference in longitude, east or west, of the standard meridian is finally found. As a check upon the computations the formula:

$$\sin A = \sin t \cos \delta \sec h$$

is used; see specimen given bottom of p. 33. On p. 32 is shown the computation of the Sun's declination and equation of time.

MAGNETIC WORK.

Declination observations.—For specimen of computations with the usual type of magnetometer, in which the scale is on the diaphragm of the observing telescope, see p. 37. For an instrument of the type in which the graduated scale is mounted in the magnet, there is some slight modification in the computation; the axis value results directly from the mean of the scale readings, magnet erect and inverted; the reduction to magnetic south meridian is, scale erect minus axis converted into arc by means of the value of one division of the scale, the difference being applied algebraically to the circle reading, that is to say, the respective circle and scale graduations are such that for an erect reading of the magnet on the scale greater than the axis value, the correction to the horizontal circle reading is positive, the circle being graduated in a clockwise direction as seen from above. The computation of approximate values of the magnetic declination as obtained with the compass attachment of the dip circle is shown on the specimen form, p. 40.

Horizontal intensity observations.—As shown on the specimen forms, pp. 34, 35, the horizontal intensity is computed by means of the formulæ:

$$mH = \frac{\pi^2 K}{T^2} \qquad \frac{H}{m} = \frac{C}{\sin u}$$

T is the time of one oscillation corrected for rate of chronometer, torsion, temperature effects, amplitude, and induction; K is the moment of inertia of the oscillating magnet and suspension, and m its magnetic moment; u is the mean deflection angle, and C the constant, corrected for changes in length of brass deflection bar with temperature, which involves the deflection distance r, induction coefficient μ, and distribution coefficients P and Q, thus:

$$C = \frac{2\left(1 + \frac{P}{r^2} + \frac{Q}{r^4}\right)}{r^3\left(1 + \frac{2\mu}{r^3}\right)}$$

Total intensity observations.—For stations in high magnetic latitudes, the determination of total intensity, F, with the dip circle by Lloyd's method has been extensively used, and values of horizontal intensity, H, have been obtained by the formula,

$$H = F \cos I$$

where I is dip. A complete specimen observation and reduction is shown on pages 38 and 39; see also p. 29. As this method is a relative one, it is essential that no change be made in the weight used nor in its position and that the magnetization of the two needles remain unchanged after the constants have been determined at some base station. A frequent control of the constant C, which occurs in the reduction formula, is essential; from the repeated determinations, the necessary corrections for loss of magnetic moment of deflecting needle as well as temperature correction can be applied to the observed values of F. The formula is:

$$F = C \sqrt{\cos I' \csc u \csc u_1}$$

where I' is the loaded dip angle, $u = I - I'$, and u_1 is the single deflection angle. In the modified form of Lloyd-Creak dip circle, as already described, two deflecting distances may be used and thus there result two independent determinations of the total intensity.

Inclination observations.—The form of observations with the dip circle as well as of computation is fully shown on pp. 36 and 39. The values of dip indirectly obtained from the deflection observations, when observing for total intensity by Lloyd's method, are utilized, provided that, for range of dip covered, reliable corrections to standards are available. For specimen form of observations and of computation with the earth inductor see p. 41.

DETERMINATION OF CONSTANTS.

The constants required in the reduction of the magnetometer observations are (*a*) value of one division of scale used in reading position of suspended magnet; (*b*) the deflection distances; (*c*) measurement of dimensions and mass of auxiliary inertia bar for computation of its moment of inertia; (*d*) the moment of inertia of the long magnet together with its suspension; (*e*) induction coefficient of the long magnet; (*f*) distribution coefficients P and Q; (*g*) temperature coefficient of the long magnet.

The measurement of the deflection distances and those for dimensions and mass of the auxiliary inertia bar are made by the usual means of standard meter and comparator, micrometer calipers, and balance; these are all referred to standard temperature of 20° centigrade. The inertia bars generally used are cylindrical and of drawn brass; occasionally, owing to non-homogeneity of the material, some of the bars are found imperfect and must be rejected. The adopted moment of inertia of the long magnet depends upon several well-tested inertia bars. For this purpose, instruments of the same type built by the Department have their parts interchangeable.

The value of one scale division, where the graduation is on a glass diaphragm in the reading telescope, is quickly obtained by setting the successive scale marks on a very distant object and reading the horizontal circle; thus, horizontal circle readings are obtained for every fifth division, 0, 5, 10, 15, etc., to the nth division and back in the reversed order, $n - 5$, . . . 10, 5, 0, the setting of the middle division on the object being repeated so that successive values of $\frac{1}{2}n$ divisions in arc may be obtained, thus $(\frac{1}{2}n - 0)$, $(\frac{1}{2}n + 5) - 5$, etc. For instruments in which the scale is mounted on the magnet, similar readings of the horizontal circle are made by sighting on the successive scale divisions of the magnet, care being taken to reverse the order of operation in the second half-set so as to eliminate, as far as possible, diurnal variation effects.

For the determination of the moment of inertia of the magnet and suspension, a number of oscillation observations with and without the inertia bar are made, thus a, ab, ab, a, a, ab, ab, a, a, etc., concluding with a, where a is a complete set of oscillations without the inertia bar and ab a complete set with the inertia bar. These observations are then grouped in pairs 1 and 2, 3 and 4, etc. If T is the time of an oscillation without the bar, corrected for the rate of chronometer, induction effect, torsion effect, and to the temperature of its corresponding set with the bar, and T_1 is the mean time of the oscillation with the bar, corrected for rate of chronometer, induction effect, and torsion effect, and if K_1 is the computed moment of inertia of the inertia bar reduced to the temperature for T_1, then the moment of inertia of the system is:

$$K = \frac{T^2 K_1}{T_1^2 - T^2}$$

For the determination of the induction coefficient both Weber's and Lamont's methods have been used. Plate 6, Fig. 1, shows the coil as used in the first method, the observation being as follows: the instrument is oriented so that the coil may be rotated in the plane of the magnetic prime vertical, connection being made with a ballistic galvanometer of high sensitiveness; the empty coil is rotated through 180° in the vertical plane, this rotation being repeated at intervals agreeing with the period of the galvanometer until the extreme deflection of the galvanometer, a_0, expressed in arc, is determined. The magnet, the induction coefficient of which is being determined, is then centered in the coil by some convenient arrangement, *e. g.*, a wood frame, and the coil rotated, the galvanometer read as before, thus determining a deflection a; the coil is then placed in a vertical position and the small auxiliary magnet, the magnetic moment of which, m_1, may be determined with sufficient accuracy by the method of deflections, is brought rapidly from some distance, mounted in the middle of the coil and then quickly withdrawn, this operation being repeated until the extreme swing of the galvanometer is obtained, the total deflection being a_1. The induction coefficient, h, may be reduced from the data so obtained by the formula:

$$h = \frac{m_1(a - a_0)}{2mZa_1}$$

where Z is the vertical intensity of the Earth's field at the place of observation and m the magnetic moment of the magnet whose induction coefficient is being obtained. The quantity, $\mu = mh$, may be derived directly by the formula:

$$\mu = mh = \frac{m_1(a - a_0)}{2Za_1}$$

Plate 6, Fig. 2, shows the apparatus used in determining the induction coefficient by Lamont's method. The magnet whose induction coefficient is to be determined is used to deflect a suspended magnet mounted as usual in the magnetometer, the deflecting magnet, however, having its length in a vertical direction at right angles to and some distance above or below the horizontal plane through the suspended magnet. The arm carrying the magnet being tested may be quickly rotated through 180° vertically; suitable arrangements are made for adjusting the center of rotation to the height of the suspended magnet. Deflection observations are made (1) with the north end of the magnet up and the magnet up, then (2) north end of the magnet down and the magnet down; the magnet is then turned about so that (3) the north end is up and the magnet still down, and finally the arm is rotated through 180° so that (4) the north end of the magnet is down while the magnet itself is up; these operations are then repeated in the reverse order. The change in the resulting deflection angles measures the alteration in the magnetic moment due to the induction of the Earth's vertical intensity, Z. The induction coefficient, h, is computed by the formula:

$$h = \frac{\tan \frac{1}{2}(u_2 - u_1)}{H \tan I \tan \frac{1}{2}(u_2 + u_1)}$$

u_2 and u_1 being the mean deflection angles obtained from the positions 2 and 4, and 1 and 3 respectively. Such observations, in order to eliminate accidental errors, are made at three or four deflection distances, both horizontal and vertical. Except when there are a great many magnets to be tested at the same time Lamont's method is on the whole more convenient.

For the determination of the distribution coefficients P and Q, observations of deflections are made at three distances, usually twelve or more complete sets being obtained. The outstanding differences in the values of $C'/\sin u$ for the three distances, where

$$C' = \frac{2}{r^3\left(1 + \frac{2\mu}{r^3}\right)}$$

are assumed due to the effects represented by the distribution coefficients P and Q. The resulting equations may be solved by the following substitutions, the distances used being r_1, r_2, and r_3 (r_1 being the short distance):

$$B = \frac{1}{r_1^2} - \frac{1}{r_2^2} \qquad B' = \frac{1}{r_2^2} - \frac{1}{r_3^2} \qquad B'' = \frac{1}{r_1^4} - \frac{1}{r_2^4} \qquad B''' = \frac{1}{r_2^4} - \frac{1}{r_3^4}$$

$$\left(\frac{C_2'}{\sin u_2} - \frac{C_1'}{\sin u_1}\right) = A \qquad \left(\frac{C_3'}{\sin u_3} - \frac{C_2'}{\sin u_2}\right) = A'$$

$$P' = -\frac{A'B'' - AB'''}{B'B'' - BB'''} \qquad Q' = \frac{A'B - AB'}{B'B'' - BB'''} \qquad P = P'\frac{H}{m} \qquad Q = Q'\frac{H}{m}$$

As the first values of P and Q must be determined by an approximate value of H/m, a second approximation is sometimes necessary. The coefficients, P and Q, are also determined from observations made occasionally in the field, particularly so at stations where comparisons of instruments with standards have been made. In such cases, the observer carries out the usual field program of intercomparison by using different pairs of deflection distances on different days, the various distances being r_1, r_2, and r_3, etc., used in pairs 1 and 3, 2 and 4, 3 and 5, etc. Equations of the form:

$$\frac{C_1' \sin u_3}{C_3' \sin u_1}\left(1 + \frac{P}{r_1^2} + \frac{Q}{r_1^4}\right) = 1 + \frac{P}{r_3^2} + \frac{Q}{r_3^4}$$

are established for each pair. From the various pairs normal equations may be formed and solved by the method of least squares.

For obtaining the temperature coefficient, q, observations made for determining the distribution coefficients are used, as this work extends over three or four days, and generally sufficient range of temperature is had to secure fairly accurate values of q by grouping the results for the magnetic moment, m, according to high and low temperatures. This method has been adopted in preference to the ice-and-boiling-water-bath method as approximating more nearly to natural conditions. Furthermore the compilation of values of the magnetic moment of long magnet, reduced to the standard temperature of 20° C., as resulting from the field work, serves to improve the value of the temperature coefficient first used.

It has not been possible to set forth more fully in this publication the methods of observation and reduction in use by the Department. They are substantially the same as those adopted by the writer when in charge of the magnetic work of the United States Coast and Geodetic Survey. The reader desiring further information may therefore be referred to the following publications issued by the Coast and Geodetic Survey: Principal Facts of the Earth's Magnetism, by L. A. Bauer, Washington, first published in 1902 and reprinted in 1909; Directions for Magnetic Measurements, by D. L. Hazard, Washington, 1911.[1]

[1] For more extensive reference to the theory and methods of magnetic measurements the following publications, among others, may be given: Handbuch des Erdmagnetismus, by Lamont, Berlin, 1849; A treatise on magnetism, by G. B. Airy, London, 1870; A treatise on magnetism, by Humphrey Lloyd, London, 1874; Directions for magnetic observations with portable instruments, by C. A. Schott, U. S. Coast and Geodetic Survey, Washington, 1881; Theory of magnetic measurements, by F. E. Nipher, New York, 1886; Traité de Magnétisme Terrestre, by E. Mascart, Paris, 1900; Erdmagnetismus, Erdstrom und Polarlicht, by A. Nippoldt, Jr., Leipzig, 1903; The law of action between magnets, by Charles Chree, Philosophical Magazine, August, 1904; Ableitung des Ausdrucks für die Ablenkung eines Magnetnadel durch einen Magnet, by C. Börgen, Hamburg, 1891; see also *Terrestrial Magnetism and Atmospheric Electricity*, vol. 1, 1896, p. 176. Reference might also be made to the various volumes of this journal for later developments in theory and practice of magnetic measurements.

SPECIMEN SUMMARIES OF CONSTANTS.

There is given below, as specimen, a copy of the constants for Magnetometer No. 9, designed by the Department, as also of the constants for a Dover Dip Circle No. 205:

Constants of C. I. W. Magnetometer No. 9.

Scale value: 1 division = 1′.48

Correction of observed declination to provisional International Magnetic Standard: + 0′.7

(To be applied algebraically, counting east declination positive and west declination negative.)

Horizontal intensity constants at 20° centigrade:

Log C for distance r, 10 being added to the characteristic is:

25 cm.	27.5 cm.	30 cm.	35 cm.	40 cm.
6.11607	5.99052	5.87591	5.67364	5.49852

At temperature t degrees centigrade:

$$\log C = \log C \text{ at } 20° + (20° - t)0.0000235$$

Table of $(20° - t)0.0000235$ in units of 5th decimal.

$(20° - t)$	0	1	2	3	4	5	6	7	8	9
0°	0	2	5	7	9	12	14	16	19	21
10	24	26	28	31	33	35	38	40	42	45
20	47	49	52	54	56	59	61	63	66	68
30	70	73	75	78	80	82	85	87	89	92

Temperature coefficient: $q = 0.00044$ per degree centigrade

Induction coefficient: $\mu = mh = 4.03$

Distribution coefficients: $P = + 15.01$ $Q = - 468$

Moment of inertia:

Magnet 9L.		*Inertia bar No. 9.*	
Temp. Cent.	log $\pi^2 K$	Temp. Cent.	log K_1
0°	3.37429	0°	2.37570
10	39	10	586
20	49	20	601
30	59	30	617
40	69	40	632

Correction of observed horizontal intensity to provisional International Magnetic Standard: − 0.00018H

(If, for example, the observed value is 0.20000 C.G.S. the corrected value will be $0.20000 - (0.00018 \times 0.20000) = 0.19996$ C.G.S.)

Constants of C. I. W. Magnetometer No. 9—Concluded.

Temperature correction table for magnet 9L $q=0.00044$			Table of values $\log\left(1+\mu\frac{H}{m}\right)$ for magnet 9L	
$(t-t_s)$ $(t'-t)$ Cent.	$t'-t=-;\ t-t_s=+$ $\log[1-(t'-t)q]$ $\log[1+(t-t_s)q]$	$t'-t=+;\ t-t_s=-$ $\log[1-(t'-t)q]$ $\log[1+(t-t_s)q]$	$\log\frac{H}{m}$	$\log\left(1+\mu\frac{H}{m}\right)$
1°	+0.00019	−0.00019	6.00	0.00017
2	38	38		
3	57	57	.10	022
4	76	76		
5	95	95	.20	028
6	114	115		
7	133	134	.30	035
8	152	153		
9	171	172	.40	044
10	190	191		
11	209	210	.50	055
12	229	229		
13	248	248	.60	069
14	267	268		
15	286	288	.70	087
16	305	307		
17	324	326	.80	110
18	342	345		
19	361	364	.90	139
20	380	383		
21	399	403	7.00	173

Constants of Dover Dip Circle No. 205.

Compass attachment:

Correction of observed declination to Standard +5′.0

(To be applied algebraically, counting east declination positive and west declination negative.)

Dip needle corrections at Washington (I = 70°.6):

Needle No.	1	2	5	6	3 deflected	7 deflected
Correction to Standard	−0′.6	0′.0	−0′.2	−1′.1	+0′.4	−1′.5

(These corrections may be different for other values of dip; they are to be applied algebraically to observed dip, regarding northerly dip as positive.)

Total intensity constants:

Values based on Standard and determined from four sets at Washington, D. C., April 11 to 15, 1910.

Needle pair 3 and 4.

Loaded dip needle No. 4 with weight 31 in S end; log C_l at 22°.8 Cent. is: 9.63849

Deflections No. 3 by No. 4, mean of No. 3 direct and reversed, log C_d at 22°.8 Cent. is: 9.51500

Hence log C: 9.57674

Needle pair 7 and 8.

Loaded dip needle No. 8 with weight 31 in S end; log C_l at 22°.8 Cent. is: 9.64314

Deflections No. 7 by No. 8, mean of No.7 direct and reversed, log C_d at 22°.8 Cent. is: 9.50634

Hence log C: 9.57474

Constants of Dover Dip Circle No. 205—Concluded.

Formulæ:

$C_l = K/m = H \sec I \sin u \sec I'$,

$C_d = K_1 m = H \sec I \sin u_1$,

$C = H \sec I \sqrt{\sin u \sin u_1} \sec I'$.

Where I = magnetic dip, I' = loaded dip, $u = I - I'$, u_1 = deflection angle, H = magnetic horizontal intensity; log C_l at t° = log C_l at $t^\circ - (t^\circ_s - t^\circ)q$; log C_d at t° = log C_d at $t^\circ_s + (t^\circ_s - t^\circ)q$ where t°_s is the temperature for which constants are given and q is the effect of one degree difference in temperature on logarithm of constant. The usual value of q is of the order 0.00010 but no determinations have as yet been made for these needles. (It is much preferable and requires very little extra time to observe invariably both loaded dip and deflections as log C is very nearly constant and requires no temperature correction. Log C is furthermore free from effect due to change with time in the magnetic moment of the deflecting needle.)

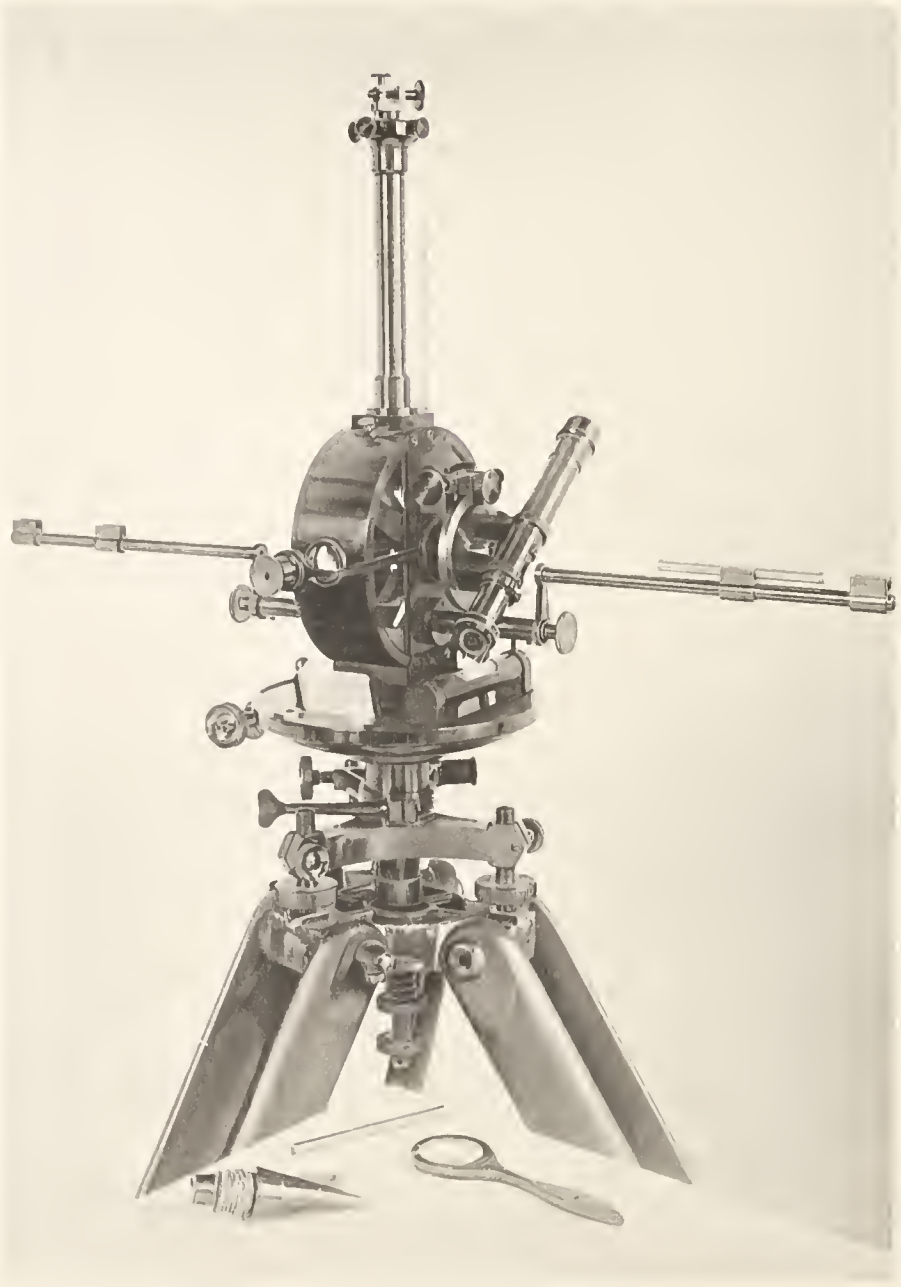
SPECIMENS OF OBSERVATIONS AND OF COMPUTATIONS.

To assure uniformity in methods of observation and of computation both in the field and in the Office, printed forms are used throughout the work. These are shown by the specimens contained in this section. With the aid of the explanations given in the three preceding sections, the reader will doubtless have no difficulty following the forms.

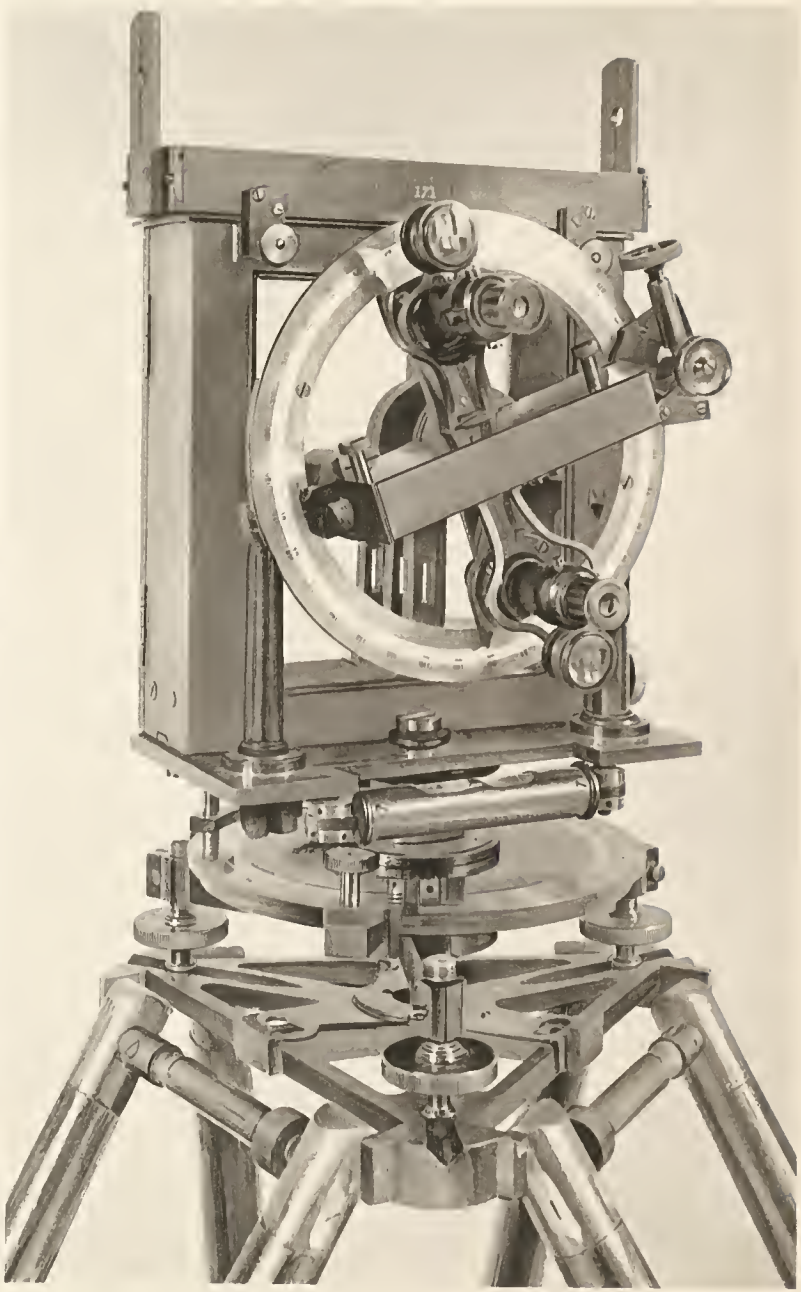
First are given (pages 31–37) the magnetic and astronomical observations, together with the computations, for a typical station in medium magnetic latitude, *viz.*, Tekrit, Russia. Pages 31–33 contain the astronomical observations for the determination of latitude, azimuth, and time (longitude), and the necessary computations. The observations and computations required for the determination of the three magnetic elements, the horizontal intensity, inclination, and declination, as obtained with a magnetometer and a dip circle, are shown on pages 34–37. In the bottom table, page 37, is given a general summary of the results obtained at this station.

Specimen total intensity observations made at Middlebury, Vermont, with a dip circle, will be found on pages 38 and 39, as also the computations, and on page 40 are given specimen declination observations for the same station, using the compass attachment belonging to the dip circle.

Finally, on page 41, are shown inclination observations made with an earth inductor at Cheltenham, Maryland.



1. Magnetic Survey of France Theodolite and Magnetometer of type 3.



2. Land Dip Circle and Compass Attachment.

PLATE 4

ASTRONOMICAL OBSERVATIONS AND COMPUTATIONS.

Observations of Sun for Latitude.

Station: Tekrit, Asiatic Turkey
Theodolite: Mag'r. No. 7
Chronometer: 257

Date: Tues. Dec. 13, 1910
Observer: W. H. S.
Temperature: 16°.0 Cent.

App't Sun's Limb	V. C.	Chronometer Time	Vertical Circle A	Vertical Circle B	Vertical Circle Mean
		h m s	° ′	′	° ′
U	R	8 53 52	212 44.2	42.5	32 43.4
L	L	8 55 13	328 10.0	09.0	31 50.5
L	L	8 55 55	328 09.8	08.8	50.7
U	R	8 57 04	212 45.0	44.0	32 44.5
U	R	8 57 46	212 45.3	44.2	44.8
L	L	8 58 58	328 08.8	07.8	31 51.7
L	L	8 59 40	328 08.7	07.7	51.8
U	R	9 01 02	212 45.5	44.5	32 45.0
U	R	9 01 43	212 45.7	44.7	45.2
L	L	9 02 50	328 08.7	07.7	31 51.8
L	L	9 03 35	328 09.2	08.0	51.4
U	R	9 04 47	212 45.7	44.7	32 45.2
U	R	9 05 30	212 45.5	44.5	45.0
L	L	9 06 30	328 09.5	08.5	31 51.0
L	L	9 07 11	328 09.7	08.5	50.9
U	R	9 08 19	212 44.8	43.7	32 44.2

Remarks:		° ′
	Obs'd max. alt.	32 18.5
	R. & P.	− 1.4
	h	32 17.1
	ζ	57 42.9
	δ	−23 06.7
	φ (North)	34 36.2

Computation of Latitude from Circummeridian Altitudes of Sun.

Station: Tekrit, Asiatic Turkey

Date: Tues. Dec. 13, 1910

	h	*m*	*s*
Chron. correction on L. M. T.	+ 2	52	07
Local mean time of app. noon	11	53	57
Chron. time of apparent noon	9	01	50

t	m	A	Am	Reduced h of Sun's limb	Reduced h of ⊙
m s	′		′	° ′	° ′
−7 58	2.08		1.87	32 45.22	
−6 38	1.44		1.30	31 51.80	32 18.51
−5 55	1.14		1.03	51.73	
−4 46	0.74		0.67	32 45.17	18.45
−4 04	0.54		0.49	45.24	
−2 52	0.27		0.24	31 51.94	18.59
−2 10	0.15		0.14	51.94	
−0 48	0.02	0.90	0.02	32 45.02	18.48
−0 07	0.00		0.00	45.20	
1 00	0.03		0.03	31 51.83	18.52
1 45	0.10		0.09	51.49	
2 57	0.28		0.25	32 45.45	18.47
3 40	0.44		0.40	45.40	
4 40	0.71		0.64	31 51.64	18.52
5 21	0.94		0.85	51.75	
6 29	1.38		1.24	32 45.49	18.62

Remarks:				
	log* cos δ	9.9637	Mean	32 18.52
	" cos φ	9.9155	R. & P.	− 1.36
	" csc ζ†	0.0729	h	32 17.16
	" A	9.9521	ζ	57 42.84
			δ	−23 06.69
			φ (North)	34 36.2

* Use four-place logs.

† ζ = meridian passage zenith distance.

ASTRONOMICAL OBSERVATIONS AND COMPUTATIONS.

Observations of Sun for Azimuth and Time.

Station: Tekrit, Asiatic Turkey
Theodolite: Mag'r. No. 7
Chronometer: 257

Date: Tues. Dec. 13, 1910
Observer: W. H. S.
Temperature: 6°.5 C.

App't Sun's Limb	V. C.	Chronometer Time	Horizontal Circle A	Horizontal Circle B	Horizontal Circle Mean	Vertical Circle A	Vertical Circle B	Vertical Circle Mean
			° ′ ″	′ ″	° ′ ″	° ′	′	° ′
	R	Mark A	274 03 00	03 30	274 03 15			
	L		94 03 40	03 20	94 03 30	274 03.4		
		h *m* *s*						
⊙	L	5 18 27	238 58 30	58 10	238 58 20	348 42.0	41.0	11 18.5
⊙	L	5 20 04	239 15 00	14 50	239 14 55	348 26.7	25.5	11 33.9
⊙	R	5 22 05.5	59 00 50	00 30	59 00 40	192 47.7	46.5	12 47.1
⊙	R	5 23 43.5	59 17 00	17 00	59 17 00	193 02.5	01.5	13 02.0
1 & 4		5 21 05.2			59 07 40			12 10.2
2 & 3		21 04.8			07 48			10.5
I		5 21 05.0			59 07 44	R. & P.	−4′.3	12 10.4
⊙	R	5 25 51	59 39 20	39 00	59 39 10	193 22.5	21.5	13 22.0
⊙	R	5 27 21	59 54 20	54 10	59 54 15	193 36.5	35.5	13 36.0
⊙	L	5 29 16.5	240 50 30	50 20	240 50 25	346 60.0	59.0	13 00.5
⊙	L	5 30 49.5	241 06 00	05 40	241 05 50	346 46.0	44.5	13 14.8
1 & 4		5 28 20.2			60 22 30			13 18.4
2 & 3		28 18.8			22 20			18.2
II		5 28 19.5			60 22 25	R. & P.	−3′.9	13 18.3
	L	Mark A	94 03 40	03 10	94 03 25			
	R		274 02 50	03 10	274 03 00	274 03.2		
	L	Mark B	73 53 50	53 30	73 53 40			
	R		253 52 50	52 50	253 52 50	253 53.2		

Computations of Sun's δ and E.

Civil Date	Dec. 13, 1910		Dec. 13, 1910	
Interval in hours and tenths from Gr. M. noon	*h* −6.7	*h* −6.6	*h* 0.6	*h* 0.6
	′	′	′	′
Hourly change in δ at Gr. M. N.	−0.179		0.179	
Corr'n account time interval	+0.003		0.000	
Mean hourly Δ δ for time interval	−0.176	0.176	0.179	0.179
Corr'n to δ at Gr. M. N.	+1.2	+1.2	−0.1	−0.1
	° ′	° ′	° ′	° ′
δ	−23 06.0	−23 06.0	−23 07.3	−23 07.3
	s	*s*	*s*	*s*
Hourly change in E at Gr. M. N.	+1.173		+1.173	
Corr'n account time interval	+0.002		0.000	
Mean hourly Δ E for time interval	+1.17		+1.17	
Corr'n to E at Gr. M. N.	−7.8	−7.7	+0.7	+0.7
	m *s*	*m* *s*	*m* *s*	*m* *s*
E	−6 07.4	−6 07.3	−5 58.9	−5 58.9

ASTRONOMICAL OBSERVATIONS AND COMPUTATIONS.

Computation of Longitude and Azimuth.

Station: Tekrit, Asiatic Turkey

Date	Dec. 13, 1910. A. M.		December 12, 1910. P. M.	
	° ′	° ′	° ′	° ′
h	12 06.1	13 14.4	13 14.8	12 17.9
ϕ	34 36.2	34 36.2	34 36.2	34 36.2
p	113 06.0	113 06.0	113 07.3	113 07.3
2s	159 48.3	160 56.6	160 58.3	160 01.4
s	79 54.2	80 28.3	80 29.2	80 00.7
s−p	− 33 11.8	− 32 37.7	− 32 38.1	− 33 06.6
s−h	67 48.1	67 13.9	67 14.4	67 42.8
s−ϕ	45 18.0	45 52.1	45 53.0	45 24.5
log sec s	0.75619	0.78111	0.78179	0.76083
" sec (s−p)	0.07738	0.07460	0.07463	0.07695
" sin (s−h)	9.96656	9.96476	9.96479	9.96628
" sin (s−ϕ)	9.85175	9.85597	9.85608	9.85256
" ctn^2 $\frac{1}{2}$ A	0.65188	0.67644	0.67729	0.65662
" ctn $\frac{1}{2}$ A	0.32594	0.33822	0.33864	0.32831
	° ′	° ′	° ′	° ′
A from South	50 32.8	49 18.4	49 15.9	50 18.3
Circle reads	259 07.7	60 22.4	38 58.2	40 00.5
S. Mer. "	109 40.5	109 40.8	349 42.3	349 42.2
Mark "	274 03.4	274 03.2	154 04.8	154 04.2
Az. of Mark	164 22.9	164 22.4	164 22.5	164 22.0
Mean	164 22.4			
log sec (s−p) sin (s−h)	0.04394	0.03936	0.03942	0.04323
" tan $\frac{1}{2}$ t	9.71800	9.70114	9.70078	9.71492
	° ′ ″	° ′ ″	° ′ ″	° ′ ″
t in arc	55 09 53	53 21 34	53 19 17	54 49 55
	h m s	*h m s*	*h m s*	*h m s*
t	− 3 40 39.5	− 3 33 26.3	+ 3 33 17.1	+ 3 39 19.7
E	− 6 07.4	− 6 07.3	− 5 58.9	− 5 58.9
Local M. T.	8 13 13.1	8 20 26.4	15 27 18.2	15 33 20.8
Chron. time	5 21 05.0	5 28 19.5	12 35 10.8	12 41 14.0
Δt on L. M. T.	2 52 08.1	2 52 06.9	2 52 07.4	2 52 06.8
Δt on G. M. T.	− 2 39.0	− 2 39.0	− 2 39.0	− 2 39.0
$\Delta\lambda$	2 54 47.1	2 54 45.9	2 54 46.4	2 54 45.8
Mean	+ 2 54 46.3		λ = 43° 41′.6E.	

Check Azimuth Computations.

Formula: sin A = sin t cos δ sec h

Set	I	II	III	IV
	° ′ ″	° ′ ″	° ′ ″	° ′ ″
t	55 09 53	53 21 34	53 19 17	54 49 55
	° ′	° ′	° ′	° ′
δ	23 06.0	23 06.0	23 07.3	23 07.3
h	12 06.1	13 14.4	13 14.8	12 17.9
A computed	50 32.8	49 18.4	49 15.9	50 18.3
log sin t	9.91424	9.90439	9.90417	9.91247
" cos δ	9.96370	9.96370	9.96363	9.96363
" sec h	0.00976	0.01170	0.01171	0.01008
" sin A	9.88770	9.87979	9.87951	9.88618
" sin A_c	9.88770	9.87979	9.87952	9.88618

MAGNETIC OBSERVATIONS AND COMPUTATIONS.

Horizontal Intensity: Oscillations.

Station: Tekrit, Asiatic Turkey *Date:* Tues. Dec. 13, 1910 *Obs'r:* W. H. S.
Instrument: Mag'r No. 7 Magnet: 7L(E)
Chronometer: 257 daily rate gaining 0.4 sec. on mean time.

Number of oscillation	Chronometer time	Temp. t′	Extreme scale readings		Time of 70 oscillations
	h m s	°	*d*	*d*	
0	6 32 50.8	10.5	22	78	
5	33 08.8				
10	26.7				
15	44.7				
20	34 02.6				
25	20.5				
30	38.4				
35	56.4				
40	35 14.3				
45	32.2	10.7	27	73	
					m s
70	37 01.9				4 11.1
75	19.8				.0
80	37.7				.0
85	55.7				.0
90	38 13.7				.1
95	31.5				.0
100	49.4				.0
105	39 07.4				.0
110	25.3				.0
115	43.2	10.9	31	69	.0
					s
Means	6 36 17.0	10.70			251.02

Formulæ: $T^2 = T'^2\left(1+\frac{h}{f}\right)\left(1-(t'-t)q\right)\left(1+\mu\frac{H}{m}\right)$; $mH = \frac{\pi^2 K}{T^2}$.

Coefficient of torsion. One div. = 1.′49

Tors. circle	Scale		Mean	Diff's.
13	48.2	51.8	50.00	
103	44.8	49.1	46.95	3.05
283	51.0	54.7	52.85	5.90
373	48.6	51.1	49.85	3.00

Mean v = 2.99 = 4.45

L. M. T. oscillations $h\ m$ = 9 28
$(t'-t)$ = −1.40°

Time of 1 oscil.	3.58600
Corr'n for rate*	− .00002
T′	3.5860
Log T'^2	1.10922
" $\left(1+\frac{h}{f}\right)$	0.00036
" $[1-(t'-t)q)]$	0.00029
" $\left(1+\mu\frac{H}{m}\right)$	0.00083
" T^2	1.11070
" $\pi^2 K$	3.37230
" mH	2.26160

*Plus for losing rate and minus for gaining rate.

MAGNETIC OBSERVATIONS AND COMPUTATIONS.

Horizontal Intensity: Deflections.

Station: Tekrit, Asiatic Turkey *Date:* Tues. Dec. 13, 1910 *Obs'r:* W. H. S.
Instrument: Mag'r No. 7 Chron. No.: 257
Magnet 7L(E) deflecting at right angles to Magnet 7S(E) suspended.

Mag-net	North end	Circle Readings											
		I. Distance r = 27.5 cm.						II. Distance r = 35.0 cm.					
		No.	A		B		Mean	No.	A		B		Mean
East	E	1	124 35 00		34 50		34 55	2	118 04 50		04 50		04 50
	W	4	99 39 40		39 20		39 30	3	106 07 30		07 20		07 25
	Mean	a	112 07 12					c	112 06 80				
	2 u					24 55 25						11 57 25	
West	W	5	99 32 00		31 40		31 50	6	106 04 50		04 40		04 45
	E	8	124 35 50		35 30		35 40	7	118 05 30		05 10		05 20
	Mean	b	112 03 45					d	112 05 02				
	2 u					25 03 50						12 00 35	
Mag. Mer.		$\frac{a+b}{2}$	112 05 28					$\frac{c+d}{2}$	112 05 35				

Mean Mag. S. Mer. 112° 05.5

Formulæ: $\frac{H}{m} = \left[\frac{2\left(1+\frac{P}{r^2}+\cdots\right)}{r^3\left(1+\frac{2\mu}{r^3}\right)}\right]\frac{1}{\text{Sin u}} = \frac{C}{\text{Sin u}}$; $\log H = \frac{1}{2}\left(\log\frac{H}{m} + \log mH\right)$

	I	II
2 u (mean)	24 59 38	11 59 00
u	12 29 49	5 59 30
	h m	°
Began at	6 58	Temp. 11.0
Ended at	7 17	" 11.8
		" 13.5
Mean	7 07.5	t = 12.10
Chr. to L. M. T. +	2 52.1	
L. M. T.	10 00	

Set	I	II
log C	5.99098	5.67423
" Sin u	9.33523	9.01863
" $\frac{H}{m}$	6.65575	6.65560
" mH*	2.26160	2.26160
" H	9.45868	9.45860
H	0.28753	0.28747
log m	2.80292	2.80300
log $\{1 + (t - t_s)q\}$	−0.00166	−0.00166
log m_s	2.80126	2.80134
m_s	632.79	632.91

* From oscillations.

MAGNETIC OBSERVATIONS AND COMPUTATIONS.

Dip Observations with Dip Circle.

Station: Tekrit, Asiatic Turkey *Date:* Tues. Dec. 13, 1910 *Obs'r:* W. H. S.
Dip Circle No. 202 Chron. No. 257 Needle No. 1

End of needle marked A down — Micro. A: Down

Circle East		Circle West		Circle West		Circle East	
Needle Face East		Needle Face West		Needle Face East		Needle Face West	
S	N	S	N	S	N	S	N
° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
228 15	48 00	312 10	132 10	311 50	131 54	227 53	47 47
14	01	09	10	50	56	55	48
48 14.5	48 00.5	47 50.5	47 50.0	48 10.0	48 05.0	47 54.0	47 47.5
° ′		° ′		° ′		° ′	
+48 07.5		+47 50.2		+48 07.5		+47 50.8	
° ′				° ′			
+47 58.8				+47 59.2			
° ′							
Mean: +47 59.0							

Polarities reversed. End of needle marked B down — Micro. A: Up

Circle East		Circle West		Circle West		Circle East	
Needle Face East		Needle Face West		Needle Face East		Needle Face West	
S	N	S	N	S	N	S	N
° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
227 17	47 16	312 23	172 34	312 48	132 48	227 39	47 28
16	13	23	33	47	48	40	28
15	14						
14	13						
47 15.5	47 14.0	47 37.0	47 26.5	47 12.5	47 12.0	47 39.5	47 28.0
° ′		° ′		° ′		° ′	
+47 14.8		+47 31.8		+47 12.2		+47 33.8	
° ′				° ′			
+47 23.3				+47 23.0			
° ′							
Mean: +47 23.2							

Resulting Dip: $+47^\circ\ 41.1 + 0.1^* = +47\ 41.2$

	h	*m*
Chron. time of beginning	10	07
" " " ending	11	31
Mean chronometer time	10	49
Chron. correction on L. M. T. +	2	52
Local mean time	13	41

	°	′
Magnetic Meridian reads	280	49
	100	49

Circle in Mag. prime vertical

			°	′
Circle N.	Needle	S. end	10	53
	"	N. end	10	36
Circle S.	"	N. end	190	59
	"	S. end	190	47
	Mean		10	49

*The so-called polarity correction.

Polarities reversed by 10 strokes of bar magnets on each face

MAGNETIC OBSERVATIONS AND COMPUTATIONS.

Declination Observations with Magnetometer.

Station: Tekrit, Asiatic Turkey
Instrument: Mag'r No. 7
Mark: *A*, Projection on house in Tekrit
Magnet: 7L

Date: Tues. Dec. 13, 1910
Observer: W. H. S.
Chronometer: 257
Line of detorsion: 13°

Chron. Time	Magnet E or I	Scale Readings Left	Right	Mean
h m		*d*	*d*	*d*
6 20	E	41.8	48.9	45.35
21	E	42.0	48.7	45.35
23	I	48.8	52.8	50.80
24	I	48.9	52.8	50.85
25	I	49.0	52.8	50.90
26	I	49.2	52.7	50.95
28	E	43.3	47.5	45.40
29	E	44.0	46.7	45.35

		Horizontal Circle Readings Mark			Magnet		
		°	′	″	°	′	″
Before	A	273	58	00	111	05	00
	B	93	58	00	291	04	40
After	A	273	58	00	111	04	40
	B	93	58	20	291	04	40
Mean		273	58	05	111	04	45

	d
Magnet erect, mean scale	45.36
Magnet inverted, mean scale	50.88
Mean scale	48.12

	d
Mean scale reading	48.12
Center	50.00
Center—mean	+ 1.88
	′
Reduction to center	+ 2.8
	° ′
Circle reading	111 04.8
Mag'c S. M. reading	111 07.6
Mark reading	273 58.1
Azimuth of mark*	164 22.4
True S. M. reading	109 35.7
Magnetic declination (East)	+ 1 31.9

	h m
Mean chron. time	6 24.5
Chron. corr'n to L. M. T.	+2 52.1
Local mean time	9 17

Remarks

Torsion weight suspended 8 min.
Temp. 9°
Clear; northeast wind

* Counted from South around by West from 0° to 360°.

Summary Sheet of Results.

Station: Tekrit — Latitude: 34° 36′.2 N — Observer: W. H. Sligh
Country: Turkish Empire, Asia — Longitude: 43 42 E — Cahier No. 66

Element	Date 1910	Instrument	L. M. T.*	Observed Values*	Corr. to Stan.	Standard Obs'd Value	Corr'n for D. V.	Corr'n for Epoch	Value at Epoch	Remarks
			h m	° ′	′	° ′				
Declination	Dec. 13	M 7	9 17	+ 1 31.9	+ 0.1	+ 1 32.0	.....	.....	.....	.....
	.....	.....	10 59	29.6	+ 0.1	29.7	.....	.....	.....	.....
		Means				+ 1 30.8				
Inclination	Dec. 13	DC 202–1	13 41	+47 41.2	− 0.3	+47 40.9	.....	.....	.....	.....
	.....	−2	13 40	42.0	0.0	42.0	.....	.....	.....	.....
	.....	−5	13 39	44.3	0.0	44.3	.....	.....	.....	.....
	.....	−6	13 38	44.8	− 0.7	44.1	.....	.....	.....	.....
		Means				+47 42.8				
Horizontal Intensity	Dec. 13	M 7	9 44	28750γ	−28γ	28722γ	.....	.....	.....	.....
	.....	.....	10 35	34	−28	06	.....	.....	.....	.....
		Deflection distance 27.5 and 35 cms.								
		Means				28714γ				

* Enter L. M. T.'s to nearest minute; declination and inclination to nearest 0′.1; intensity to nearest γ (.00001 C. G. S.). All references are to north end of magnet; east declinations and north inclinations are counted as positive.

MAGNETIC OBSERVATIONS AND COMPUTATIONS.

Total Intensity: Loaded Dip Observations.

Station: Middlebury, Vt. *Date:* Thurs. July 28, 1910 *Obs'r:* P. N. S.
Dip Circle No. 178 Needle No. 8 loaded; wt. 31

End of needle marked A north* down — I

Circle East		Circle West		Circle West		Circle East	
Needle Face East		Needle Face West		Needle Face East		Needle Face West	
S	N	S	N	S	N	S	N
° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
224 51	45 04	315 01	135 15	315 10.5	135 17	225 06	45 15
51	04	00	15	10	17	07	15
51.0	04.0	00.5	15.0	10.2	17.0	06.5	15.0
° ′		° ′		° ′		° ′	
+44 57.5		+44 52.2		+44 46.4		+45 10.8	
° ′				° ′			
+44 54.8				+44 58.6			
				° ′			
Mean I_1': +44 56.7							

End of needle marked A north* down — II

Circle East		Circle West		Circle West		Circle East	
Needle Face East		Needle Face West		Needle Face East		Needle Face West	
S	N	S	N	S	N	S	N
° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
225 02	45 14	315 00	135 13	315 15	135 22	225 08	45 15
02	13	01	14	16	24	10	17
02.0	13.5	00.5	13.5	15.5	23.0	09.0	16.0
° ′		° ′		° ′		° ′	
+45 07.8		+44 53.0		+44 40.8		+45 12.5	
° ′				° ′			
+45 00.4				+44 56.6			
				° ′			
Mean I_2': +44 58.5							

	h	m	Temp.
Chron. time beginning	15	30	27°.4
" " ending	16	55	28 .1
Mean chron. time	16	12	27.75
Chron. corr. L. M. T.		+ 7	
Local mean time	16	19	
Magnetic Meridian reads		178°	06′
		358	06

Log. cos I'	9.84990	9.84967
" csc u	0.30762	0.30802
" csc u_1	0.30325	0.30276
Sum	0.46077	0.46045
½ Sum	0.23038	0.23022
Log. C	9.54970	9.54970
" F	9.78008	9.77992
Mean Log. F	9.78000	
Log. cos I	9.42831	F = .60256
" H	9.20831	H = .16155

° ′
Dip = I = +74 26.9; $u = I - I'$
∴ u for I = 29 30.2
u " II = 29 28.4

* Note whether north end up or down.

MAGNETIC OBSERVATIONS AND COMPUTATIONS.

Total Intensity: Deflection Observations.

Station: Middlebury, Vt. *Date:* Thurs. July 28, 1910 *Obs'r:* P. N. S.
Dip Circle No. 178 Needle No. 7 suspended 8 deflecting

End of suspended needle marked A north — I

Circle East				Circle West			
Needle Face East				Needle Face West			
Micro. Direct		Micro. Reversed		Micro. Reversed		Micro. Direct	
S	N	S	N	S	N	S	N
° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
224 43	44 52	284 15.5	104 27	255 40	75 51	315 27	135 35
42.5	52	15	27	39	51	27	35
42.8	52.0	15.2	27.0	39.5	51.0	27.0	35.0
° ′		° ′		° ′		° ′	
44 47.4		104 21.1		104 14.8		44 29.0	
+74 34.2		29 46.9		29 52.9		+74 21.9	

Mean I_1: +74 28.0 ° ′ u_1: 29 49.9

Suspended needle turned face about on bearings — II

Circle West				Circle East			
Needle Face East				Needle Face West			
Micro. Direct		Micro. Reversed		Micro. Reversed		Micro. Direct	
S	N	S	N	S	N	S	N
° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
315 08	135 20	255 38	75 54	284 21.5	104 35.5	224 20	44 34
07	20	38	54	17.5	32	19	31
07.5	20.0	38.0	54.0	19.5	33.8	19.5	32.5
° ′		° ′		° ′		° ′	
44 46.2		104 14.0		104 26.6		44 26.0	
+74 30.1		29 43.9		30 00.3		+74 26.3	

Mean I_2: +74 28.2 ° ′ u_1: 29 52.1

Resulting Dip: +74° 28′.1

	h	m	Temp.
Chron. time beginning	15	47	27°.8
" " ending	16	15	28 .0
Mean chron. time	16	01	27 .9
Chron. corr. L. M. T.		+ 7	
Local mean time	16	08	
Magnetic Meridian reads	178°	06′	
	358	06	

REMARKS:

MAGNETIC OBSERVATIONS AND COMPUTATIONS.

Declination Observations with Compass.

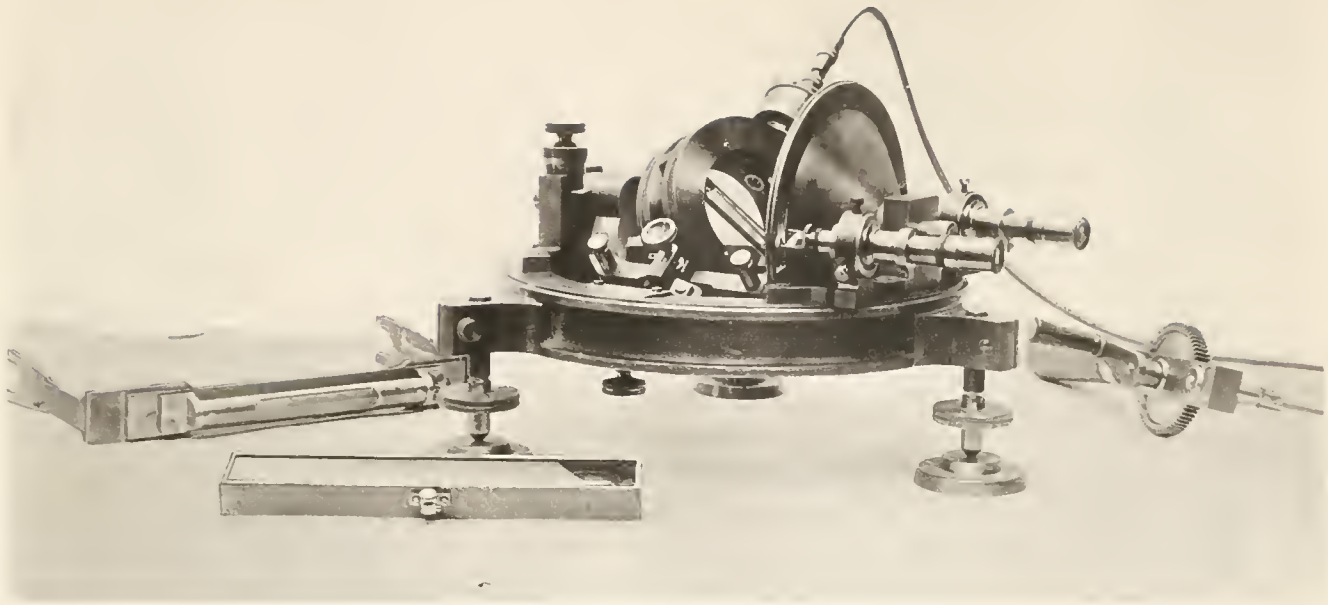
Station: Middlebury, Vt. *Mark:* East gable of C. James house
Date: Thurs. July 28, 1910 *Observer:* P. N. S.
Instrument: Compass Dip Circle No. 178 Chron. No. 256

Chron. time	Mark beginning R. and D.	Instrument direct: Needle at 0° / at 0°		Instrument direct: Needle at 5° E. / at 5° W.		Mark ending D. and R.
I		North end	South end	South end	North end	
h m	° ′	° ′	° ′	° ′	° ′	° ′
14 05	302 05.5	178 07 07	178 05 05	173 05 02	173 07 08	122 05.5
14 30	122 05.5	178 08 08	178 06 06	183 07 05	183 07 09	302 05.5
14 17.5	302 05.5	178 07.5	05.5	04.8	07.8	302 05.5
Means	302 05.5	178 06.5		178 06.3		
II						
h m						
17 24	302 06.0	178 11 12	178 10 10	173 10 09	173 11 10	122 05.0
17 35	122 05.0	178 12 12	178 10 10	183 11 11	183 13 12	302 06.0
17 29.5	302 05.5	178 11.8	10.0	10.2	11.5	302 05.5
Means	302 05.5	178 10.9		178 10.8		

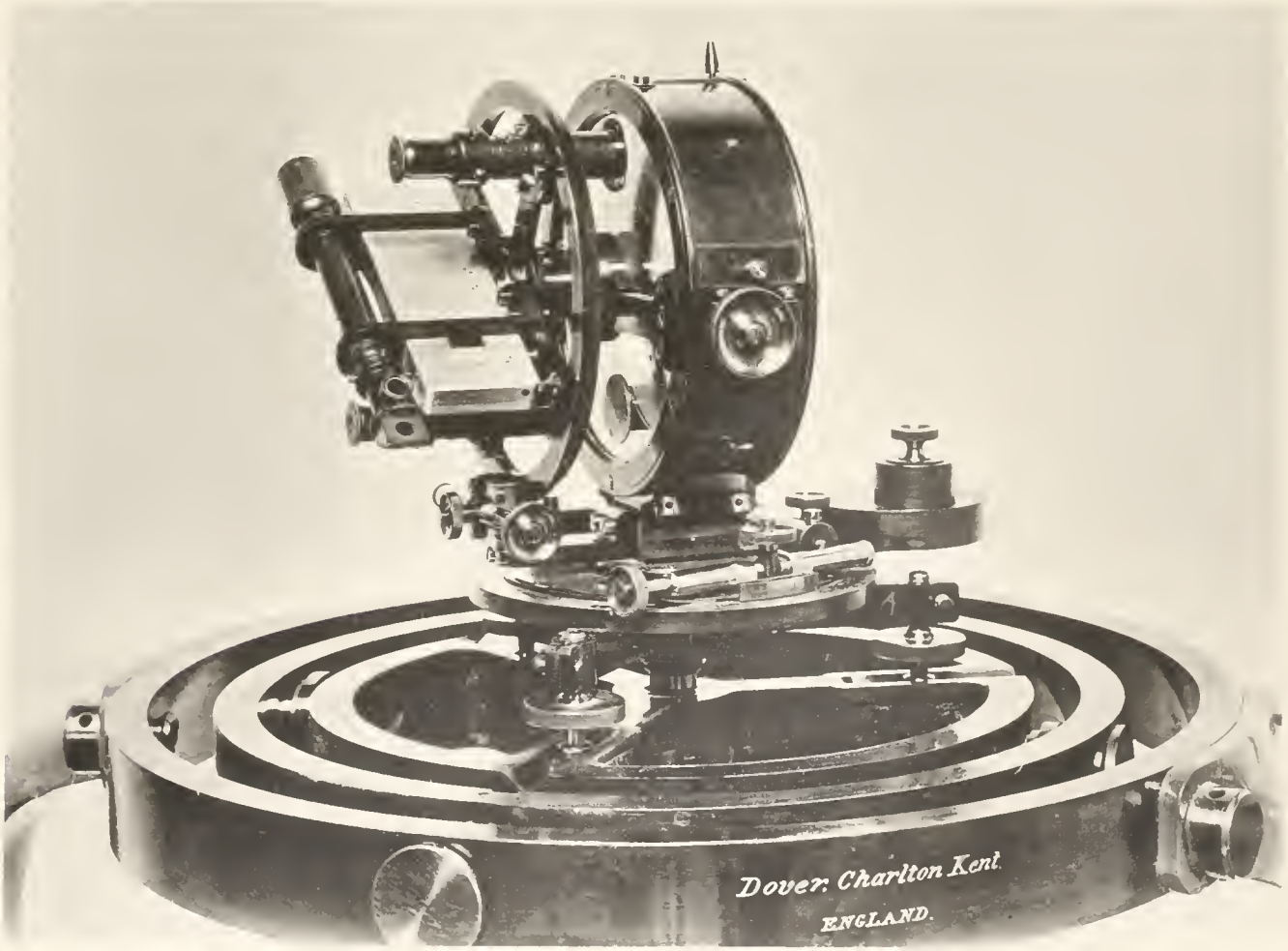
Chronometer correction to L. M. T.: $+7^m$

Local mean time	*h* *m* 14 24	*h* *m* 17 36	Remarks
	° ′	° ′	
Mag'c S. M. reading	178 06.4	178 10.8	
Mark reading.	302 05.5	302 05.5	
Azimuth of mark*	111 07.4	111 07.4	
True S. M. reading	190 58.1	190 58.1	
Magnetic declination	− 12 51.7	− 12 47.3	
Index correction	− 3.0	− 3.0	
Diurnal var. correction			
Resulting declination			
Mean			

* Counted from south around by west.



1. Wild-Eschenhagen Earth Inductor.



2. Lloyd-Creak Ship Dip Circle (modified form).

MAGNETIC OBSERVATIONS AND COMPUTATIONS.

Dip Observations with Earth Inductor.

Station: Cheltenham Obs'y, Maryland
Earth Inductor No. 48

Date: Wed. April 1, 1908 *Obs'r:* H. W. F.
Chron. No. H. W. F.

Circle east

Axis vertical					Axis inclined				
Face Coil *A*	Vertical circle			Chron. time	Rotation	Vertical circle			
	A	*B*	Mean			*A*	*B*	Mean	
	° ′	′	° ′	*h* *m*		° ′	′	° ′	
E	66 43.3	37.5	66 40.4	15 03	+	47 13.9	07.9	47 10.9	
W	43.4	37.6	40.5		−	15.1	09.1	12.1	
W	43.2	37.6	40.4		−	15.1	09.1	12.1	
E	43.3	37.6	40.4	15 15	+	13.6	07.7	10.6	
Means			66 40.4	15 09				47 11.4	

Dip for circle east +70° 31′.0

Circle west

Axis vertical					Axis inclined				
Face Coil *A*	Vertical circle			Chron. time	Rotation	Vertical circle			
	A	*B*	Mean			*A*	*B*	Mean	
	° ′	′	° ′	*h* *m*		° ′	′	° ′	
E	66 43.3	37.6	66 40.4	15 22	+	86 11.5	06.5	86 09.0	
W	43.3	37.5	40.4		−	12.0	06.5	09.2	
W	43.1	37.4	40.2		−	12.1	06.6	09.4	
E	43.1	37.5	40.3	15 31	+	11.5	05.9	08.7	
Means			66 40.3	15 26				86 09.1	

Dip for circle west +70° 31′.2

Resulting dip: +70° 31′.1

	h	*m*
Mean chron. time	15	18
Corr'n to L. M. T.		− 7
Local mean time	15	11

Remarks:

Magnetic prime vertical	
Compass end	Horizontal circle
	° ′
N	146 57
S	147 45
S	327 37
N	327 00
Mean	147 20

Magnetic meridian reads 57° 20′

REDUCTIONS TO STANDARD INSTRUMENTS.

The world-wide operations of the Department have necessitated extensive intercomparisons of magnetic instruments at Washington as well as in the field and at magnetic observatories in the regions covered. With the data thus obtained it has been possible to refer the magnetic elements for the entire region embraced in this publication to magnetic standards within an error, in general, on the order of the error of observation. While the adopted standards are termed "provisional," the numerous comparisons with Magnetic Observatory Standards, the general results of which are given in Table No. 2, show that they approach so close to international ones that the corrections here adopted may be considered as fulfilling all practical requirements of a general magnetic survey of the Earth. A separate monograph will be devoted to the observatory intercomparisons. It must suffice at present to refer the interested reader to a preliminary communication made by J. A. Fleming in *Terrestrial Magnetism and Atmospheric Electricity*, v. 16, pp. 61–84, 137–162; for a preliminary note by L. A. Bauer on an "International Magnetic Standard," see same journal, v. 12, pp. 161–164.

In the first part of Table 2, the mean results of direct comparisons between the Observatory standards and those of the Department are given; the second part contains the mean results as derived by making use of the data obtained by other organizations, showing the relation of their standards to those of some of the observatories mentioned in the first part. Throughout the table east declination, northerly dip, and horizontal intensity are regarded as positive; the differences, "C. I. W. standards minus Observatory standards," accordingly, are to be taken algebraically. Thus, since at Potsdam the magnetic declination is west, hence negative, and the dip or inclination is plus, the interpretation of the figures given in the first line of the table is as follows: West declination as observed with the C. I. W. standardized instrument (Mag'r. No. 5) was, on the average, 0′.3 less than that given by the Potsdam standard; the inclination observed with the standardized dip circle (No. 177) used by the C. I. W. observer was, on the average, 0′.3 smaller than the value obtained with the Potsdam earth inductor; the mean horizontal intensity resulting from the observations with the C. I. W. standardized magnetometer (No. 5) was $0.00024H$ or 0.000046 C. G. S. unit larger than that with the Potsdam standard.

Magnetic Standards Adopted.

The *standards adopted by the Department* for reduction to a common basis of the results contained in this volume are as follows: In declination, C. I. W. Magnetometer No. 3 without correction; in horizontal intensity, C. I. W. Magnetometer No. 3 with a correction of $+0.00015H$ applied to observed values of H, the horizontal intensity; in inclination, Earth inductor No. 48, made by Schulze, with a correction of $-0'.5$ applied to observed values of inclination, this correction being based upon direct comparisons with the standard earth inductors at the Potsdam and at the Cheltenham magnetic observatories.

TABLE 2.—*Preliminary Results of Comparisons with Magnetic Observatory Standards.*

Difference, C. I.W. Standards Minus Observatory Standards	Declination		Inclination		Horizontal Intensity		Dates and Remarks
	Mean ΔD	No. Sets	Mean ΔI	No. Sets	Mean ΔH	No. Sets	
A. RESULTS OF DIRECT COMPARISONS							
	′		′				
Potsdam	+0.3	14	−0.3	7	+0.0002H	7	Feb. 1910
Kew	+0.7	29	−1.7	11	+0.0001H	13	Mar. 1908, Mar. 1910
Pola	−0.3	14	+0.1	7	+0.0005H	7	Feb. 1910
Toronto	−0.5	32	+0.8[1]	12	+0.0002H[2]	20	Sep. and Oct. 1906 by Dept.; Oct. to Nov. 1909, and Apr., Sep., and Oct. 1910 by Meteorological Service
Tiflis	+0.7	2	−1.6[3](?)	5	+0.0004H[3]	7	June 1908[4]
Cheltenham[5]	+0.2	33	+0.1	10	−0.0008H	23	Feb. and Mar. 1908, and Mar. 1910
Zi-ka-wei	−1.0	11	−1.1	3	+0.0006H	7	May and Sep. 1907
Dehra Dun	+0.2	9	−0.1	7	+0.0016H[6]	7	Oct. 1909
Helwan	+0.5	13	+0.2	5	+0.0003H	6	Apr. 1908
Havana	+0.9	11	+1.6	6	.....	..	May 1905
Hongkong	+0.6	4	−1.2	8	+0.0022H[7]	4	Dec. 1908 for D and H, and Mar. 1911 for I
Alibag	+0.8	8	−0.7	4	−0.0011H	4	Mar. 1911
Samoa	−0.4	2	0.0	7	+0.0004H	2	May 1906 for D and H, and May and Dec. 1906 for I
Pilar	+0.6	24	0.0	9	−0.0007H	12	Jan. to Feb. 1911
Melbourne	....	..	−0.3	3	.....	..	Nov. 1906
Christchurch	+1.3	13	−1.4	18	+0.0008H	6	July 1906 and Dec. 1907 to Jan. 1908 in D and I; Dec. 1907 to Jan. 1908 for H
B. RESULTS OF INDIRECT COMPARISONS[8]							
Upsala	....	..	−1.0	..	0.0000H	..	Sep. 1908
Pavlovsk	+0.1	..	−0.8	..	+0.0006H	..	Oct. and Nov. 1908 and July 1910 for D and I; Oct. and Nov. 1908 for H
Katharinenburg	....	..	−0.3	..	+0.0005H	..	June 1908
Rude Skov	+0.3	..	−1.3	..	+0.0011H	..	Sep. 1908
Irkutsk	....	..	−1.8	..	+0.0005H	..	June to July 1908
De Bilt	+0.6	..	−1.5	..	−0.0000H	..	June 1910
Val Joyeux	+0.8	..	+1.5[9]	..	−0.0008H	..	June 1910
Tiflis	....	..	−0.4	..	+0.0006H	..	Dec. 1907

[1] This difference in I at Toronto is as based on the old observatory standard, *viz.*, Dover circle 130, needles 1 and 2, since superseded by Dover circle 200, needles 1 and 2, for which the Department has as yet no data.

[2] This difference in H at Toronto is as based on the new observatory standard, Elliott magnetometer 98, and constants adopted in February, 1911.

[3] Possible local artificial disturbance during this work. Compare the results obtained for Tiflis with the indirect comparison of December, 1907.

[4] The observatory results for the comparisons of June and July, 1909, are not yet available.

[5] The standards for the United States Coast and Geodetic Survey observatories at Sitka, Baldwin, Honolulu, and Vieques, are identical with those at Cheltenham. The same remark applies for the new observatory at Tucson, which succeeded the Baldwin Observatory, discontinued in October, 1909.

[6] This is on the basis of the value of $\pi^2 K$ of September, 1909, for the observatory standard magnetometer.

[7] Referred to magnetometer 83 at Hongkong, ΔH would be $+0.0008H$.

[8] Determined from reports of intercomparisons of Dubinsky and Kühl and Department observations at Kew and Potsdam.

[9] The difference in inclination for observatory earth inductor, Schulze 61, is −0′.5.

MAGNETOMETER CORRECTIONS.

The corrections of each instrument on adopted standards are determined at Washington with every care, both before and after use in the field, following the methods described on p. 19. Also, whenever opportunity permits, intercomparisons are obtained in the field among observers of the Department and at observatories.

The magnetometer corrections given in Table 3 depend generally upon comparisons involving two or more sets of at least twelve declination observations and twelve horizontal intensity observations at three distances each. The accuracy of the mean correction from the comparisons at any one station is usually of the order $\pm 0'.1$ in declination and $\pm 0.00005H$ in horizontal intensity. The tabulated corrections are to be applied algebraically to observed values of the declination or of the horizontal intensity; east declinations are reckoned as positive and west declinations as negative; horizontal intensity is taken always as positive.

TABLE 3.—*Magnetometer Corrections on Adopted Magnetic Standard for the Period, 1905–1910.*

No. of Magnetometer	Correction to Observed		Remarks
	Declination	Horizontal Intensity	
	′		
1	−2.1	+0.0010H	Prior to accident of February 7, 1907
1	0.0	−0.0006H	After accident of February 7, 1907, using, however, the old constants
1	−0.6	+0.0007H	After repairs and alterations in January 1908
2	+0.2	−0.00030H	
3	0.0	+0.00015H	Standard magnetometer
4	+0.7	+0.00024H	To June 30, 1908
4	+0.5	+0.00020H	August 1908 to March 1910, after replacement of lost deflection bar by new one
4	+0.5	+0.00072H	Subsequent to alterations and repairs of March 1910
5	+0.1	−0.00090H	Prior to accident of March 28, 1910;
5	−0.1	−0.00021H	Subsequent to extensive repairs of March 1910
6	+0.2	+0.00035H	
7	+0.1	−0.00096H	
8	+0.8	+0.00006H	Through 1910
8	0.0	−0.00003H	Since January 1911, after repairs and slight alterations
8CS	+0.2	−0.00036H	
9	+0.7	−0.00018H	
10	+0.7	+0.00052H	
11	+0.2	+0.0045H	For magnet system marked by one dot, designated No. 1
11	+0.6	+0.0047H	For magnet system marked by two dots, designated No. 2
12	−0.2	−0.00160H	
13	−0.2	+0.00028H	
15	+0.1	+0.00035H	
17	−0.1	+0.0012H	
19	+1.5	−0.0010H	Through 1905
20	+0.5	+0.0011H	
21	0.0	+0.0062H	For work in 1906; magnet system marked by two dots; No. 2
21	−1.2	+0.0046H	For work in 1907; magnet system marked by two dots; No. 2
24	+0.7	0.0000H	Relative constants for H from standard intercomparisons
30	+0.2	−0.00048H	
31	−1.3	−0.00165H	Through 1910
36	−0.5	+0.00113H	Through 1906
49	−1.0	+0.00058H	In 1906 and 1907
55	+0.7	+0.00065H	Using Department's compilation of constants
68	−6.6	+0.00415H	
73	+0.4	+0.00025H	Through 1910
2025	−0.5	0.0000H	Relative constants from standard intercomparisons; deflections only
7041	−1.3	−0.0006H	Declinations observed in provisional wooden housing

The effect on the horizontal intensity correction to standard, due to possible changes in the distribution coefficients, P and Q, over a period of two years or less, was especially investigated for magnetometer No. 5. This instrument was taken because of its extensive use in field and observatory intercomparisons. The distribution coefficients resulting from 23 sets of deflections at three distances each made at Washington in January and February 1908, and from a least-square adjustment of the observations at eight observatory stations during February 1908 to March 1910 (prior to accident), there being four sets or more of deflections for each of three pairs of distances at the observatory stations, were, $P = +14.59$ with a probable error of ± 0.07, $Q = -640$ with a probable error ± 6.3. The investigation showed, at least for this instrument, that with proper care in handling the magnets it will suffice for all purposes of field work to adopt mean values of P and Q for the entire period. It is of interest to note, however, that in spite of all possible care bestowed in the construction of the magnets of this magnetometer according to theoretical requirements as to dimensions, etc., the distribution coefficients were found considerably different from the theoretical values; in this connection see also tabular details for magnetometers of types 1(a) and 1(b).

DIP-CIRCLE CORRECTIONS TO STANDARD.

In the regular dip or inclination observations, the polarity of needles is invariably reversed and hence the so-called balance error due to eccentric position of center of gravity of the needle is eliminated. There remains, however, the error due to irregularity of figure of pivot and this will vary, in general, with the magnetic field. Hence the determinations of needle corrections at a base station, however carefully executed, may not necessarily apply to a region far remote where the dip and intensity are considerably different from those at the base station. Use has therefore been made not only of the comparisons at Washington, but also of all available field and observatory comparisons and a tentative relation of the following form was established whenever warranted, F being the total intensity, I, the inclination, and x, y, z, three coefficients to be determined:

$$F\Delta I = x + z \cos I + y \sin I$$

An experimental attempt was made at Washington to determine the coefficients, x, y, and z, for the required range by making use of artificially produced magnetic fields.[1] This method, however, has been abandoned at present because of the great expenditure of time required and because experience has shown it to be better to utilize results obtained under actual conditions of field work and extending over the entire period involved. In very exceptional instruments it was possible to secure some data for corrections by studying critically the differences exhibited by needles among themselves for the range of dip encountered.

The dip corrections adopted in this volume are given separately for each instrument; they are to be applied algebraically regarding dip, north end down, as positive and south end of needle down, as negative. For type of instrument referred to, see section on "Instrumental Equipment of Parties."

[1] *Cf.* Dike, P. H. Experimental investigation of dip needle corrections. *Terr. Mag.*, v. 14, 1909. (137–146.)

Dover circle 9.—This circle is of type (*a*) and was used in the work in Africa by Professors Beattie and Morrison; it belongs to the Royal Observatory, Cape of Good Hope. From the field comparisons with standardized Dover circle 142, the following corrections were determined and adopted for all observations with this instrument: needle No. 1, $-2'.5$; No. 2, $-5'.8$; No. 3, $-4'.5$; No. 4, $-4'.0$; No. 4 of circle 142, $-4'.0$; No. 6 of 142, $-5'.3$. The tabular designations as used in the Table of Results are: 9.1234 and 9.12(46), the latter for observations when needles 3 and 4 of No. 9 were replaced by needles 4 and 6 of 142.

Casella circle C. & G. S. 18.—Of type (*a*), is the property of the United States Coast and Geodetic Survey and was used during 1905 in the West Indies. The adopted corrections are: needle No. 4, $-1'.6$; No. 5 of circle 172, $-3'.1$; No. 6 of 172, $-3'.5$. The tabular designations are 18·4, and 18·4(56).

Chasselon circle 20.—Of type (*c*), belongs to the Zi-ka-wei Observatory and was loaned the Department for its earlier work in China. Owing to some magnetic impurity in the metal parts of the instrument, the correction to standard for the needle used (No. 2, marked . .) shows considerable range, varying practically linearly from $+11'$ for the dip 30° north to $-7'$ for the dip 50° north. The tabular designation is 20·2.

Chasselon circle 24.—Of type (*c*) and the property of the United States Coast and Geodetic Survey. As in the case of No. 20, there appears to be some magnetic impurity in the metal parts of the instrument. The corrections to standard are the same for both needles used, number 1 (marked .) and number 2 (marked . .) and are represented by the formula,

$$F\Delta I = +7'.5 + 11'.8 \cos (I + 36°.9)$$

derived from numerous comparisons with standards by observers of the Department as well as of the United States Coast and Geodetic Survey. The tabular designation is 24·12.

Dover circle 33.—Of the type (*a*), the property of the Zi-ka-wei Observatory and loaned the Department for some of the earlier work in China. The correction of needle No. 14 to standard is $-1'.1$ as determined from comparisons made at the Observatory with standardized circle 178. The tabular designation is 33·14.

Lloyd-Creak Dover circle C. & G. S. 34.—Type (*b*); the property of the United States Coast and Geodetic Survey. The correction on standard of the mean of values observed with needles Nos. 1 and 2 is $-1'.9$. The tabular designation is 34·12.

Lloyd-Creak Dover circle C. & G. S. 35 (Dover No. 168).—Type (*b*); the property of the United States Coast and Geodetic Survey; loaned the Department for use in the *Galilee* work 1905 to 1907. Early in 1906 the circle was modified in the instrument shops of the Coast and Geodetic Survey, the original single deflection distance of 7.3 cm. being replaced by two deflection distances of 7.9 cm. and 9.4 cm. The correction adopted for the mean value obtained with needles Nos. 1 and 2 prior to the modification of the instrument was $-2'.6$. After the modifications, early in January 1906, and continuing until December 1906, the corrections adopted from least square reductions of results of comparisons with land dip circles were as follows:

$$\text{Needle No. 2} \quad F\Delta I = -12'.8 + 14'.2 \cos I + 4'.0 \sin I$$
$$\text{Needle No. 5 of circle 163} \quad F\Delta I = -\ 2\ .7 + \ 4\ .0 \cos I - 2\ .7 \sin I$$

or, for the mean of the two needles,

$$F\Delta I = -7'.8 + 9'.1 \cos I + 0'.7 \sin I$$

Needle No. 6 of circle 163 was also used at San Diego at the beginning of the second cruise of the *Galilee* during January and February 1906; the correction adopted for the mean of needles No. 5 and No. 6 of circle 163 was $-3'.6$ for this period. In December 1906, after repairs to needle No. 1, it and No. 2 were used through July 1907, needle No. 5 of 163 being returned to its own instrument and the corrections adopted from least square reductions of results of comparisons with land dip circles were for this period:

$$\text{Needle No. 1} \quad F\Delta I = +2'.7 - 1'.4 \cos I - 3'.6 \sin I$$
$$\text{Needle No. 2} \quad F\Delta I = +9\ .2 - 9\ .4 \cos I - 4\ .8 \sin I$$

or,

$$\text{Needles Nos. 1 and 2} \quad F\Delta I = +5'.9 - 5'.4 \cos I - 4'.2 \sin I$$

During the latter half of 1907 this instrument was used in land work in Canada; the correction adopted from comparisons with standards, for the range of dip covered by this work, was $+0'.5$ for the mean value observed with needles Nos. 1 and 2.

Lloyd-Creak Dover circle C. & G. S. 35 (Dover No. 168)—continued.

Subsequent to the overhauling of the circle in June, 1908, it was used for land work in Greenland and Newfoundland. The correction adopted from standard intercomparisons, for the range of dip covered in this work, was +0′.4 for mean value observed with needles Nos. 1 and 2.

The tabular designations are 35·12, 35·2(5), and 35·12.

The *correction for declination values by the compass attachment* of circle 35 resulting from various comparisons with standardized magnetometers is: for values through June, 1908, where mark was read with peep sights, +7′.5, and for subsequent work +8′; for values where mark was read with telescope, −9′.2.

Dover circle 71.—Type (*a*); the property of the Hongkong Observatory; loaned the Department for some of the earlier work in China. The corrections adopted from comparisons at Hongkong in March, 1911, with circle 206 standardized are: needle No. 3, −1′.5; No. 4, 0′.0; No. 7, −1′.7; No. 8, −1′.6. The tabular designation is 71·3478.

Dover circle 122.—Type (*a*); the property of the Massachusetts Institute of Technology; loaned the Department during 1905 for work in Labrador and Newfoundland. The corrections adopted from standard intercomparisons are: No. 1, +0′.9; No. 2, +1′.1. The tabular designation is 122·12.

Dover circle 142.—Type (*a*); was used by Professors Beattie and Morrison for work in Africa in 1910, and belongs to one of them. Intercomparisons were obtained at the observatories, Kew, England, and Helwan, Egypt, the relations of whose standards to the Department standard had been previously determined. The following corrections as based on all available data were adopted:

Dip	Needle No. 1	Needle No. 2	Needle No. 3	Needle No. 5
°	′	′	′	′
−60	−3.4	−2.0	−2.2	−4.5
−50	−3.5	−2.2	−2.4	−4.1
−40	−3.4	−2.1	−3.0	−3.8
−30	−3.2	−2.2	−3.6	−3.2
−20	−2.8	−2.5	−3.9	−3.0
−10	−2.6	−2.6	−4.0	−3.0
0	−2.6	−2.3	−4.0	−3.2
+40	−3.4	−0.7	−3.6	−4.5
+67	−2.0	−1.1	−4.9	−4.3

The tabular designation is 142·1235.

Lloyd-Creak Dover circle 169.—Type (*b*); the property of the Department. It was used in the work of the *Galilee* in 1905, during her first cruise in the Pacific Ocean. Needles 1 and 2 were used throughout the land work of this cruise. The corrections adopted from all the land intercomparisons were: needle No. 1, −1′.1; No. 2, −3′.0. In view of the experience had with this circle and with No. 168, it was returned for modification to the maker in June, 1906; additional dip and intensity needles were supplied, two deflection distances and a telescope were provided and the pivots of needles and jewel bearings improved. The modified instrument was returned to the *Galilee* in December, 1906, and used throughout her entire third cruise in the Pacific Ocean during 1907 and 1908. The results show No. 169 to be a very superior instrument, observations made with it at land stations being comparable with those obtained with good land circles. For the work of 1907 and 1908 the corrections adopted from least square reductions of data obtained from land circle comparisons with standardized land dip circles are given by the following formulae:

Needle No. 1 $F\Delta I = -3'.9 + 5'.5 \cos I + 1'.2 \sin I$

Needle No. 2 $F\Delta I = -4.6 + 6.0 \cos I + 1.5 \sin I$

or, for the mean value by the two needles,

Mean of Needles 1 and 2 $F\Delta I = -4'.3 + 5'.4 \cos I + 1'.4 \sin I$

The tabular designation is 169·12.

The *adopted corrections for declination values by the compass attachment* of circle 169 are: for the 1905 work −2′.5; for subsequent work −2′ when the mark readings are made with the peep sights, and +3′ when the mark is read with the telescope.

Dover circle 171.—Type (*a*); the property of the Department. It was used in 1905 in the West Indies, by the *Galilee* party for part of the shore work in 1905 and a part of 1906, during 1906 in land work in Polynesia, and in 1907 to 1909 in the land work in China and Chinese Turkestan, being returned to the Office in 1910 for supplying new needle pivots and for general overhauling. The corrections adopted as based on a careful consideration of all data available are as follows: mean of needles Nos. 1 and 2 in 1905 and 1906, for values of dip from 60° north to 60° south, 0′.0, and for values of dip between 60° and 80° north and 60° and 80° south, +0′.5; mean of needles Nos. 5 and No. 6 of circle 172 during 1906 to October, 1908 for all dips, +1′.0. Subsequent to October, 1908, needles Nos. 5 and 6 of circle 172 and No. 7 of circle 178 were used; unfortunately the pivots of all three needles developed rust pits in one or two places. From an examination of the results from comparisons and from a scrutiny of the field results, the correction adopted for the mean of the three needles is 0′.0; on the average, however, the results so obtained appear to be within 2′ or less of the standard. The tabular designations are 171·12,171·(56), and 171·(567).

The *correction for declination values by the compass attachment* of circle 171, as adopted from all the intercomparison data, is +2′.5.

Dover circle 172.—Type (*a*); the property of the Department. It has been used over a large portion of North America, from Central America and the West Indies to Canada and Labrador. The corrections adopted for all values of dip for work prior to furnishing new needle pivots and generally overhauling the instrument in the latter part of 1910 are: Needle No. 1, +1′.4; needle No. 2, −2′.9, or for the mean of the two needles, −0′.8. During March and April, 1907, the deflection distance was increased about 5 mm. in order that a more extensive use of the instrument could be made in the determination of total intensity by Lloyd's method. The corrections for dips resulting from deflections of needle No. 3 by No. 4 for work prior to March, 1907, are given by the formula:

$$F\Delta I = +4'.5 - 19'.7 \cos I$$

During 1908, for a few stations where very high dips could not be observed in the field work in Canada, the results with needle No. 3 deflected were used for some of the stations, the correction adopted being −1′.2. In 1911, subsequent to the general repairs above mentioned, the corrections of the mean value from needles Nos. 1, 2, 5, and 6, were from standard earth inductor comparisons, +0′.1 for dip 70° north, and −5′.0 for the dip 60° south. The tabular designations are: 172·12 or 172·123, and 172·1256.

The *correction for declination values by the compass attachment* for the work prior to the general overhauling of 1910 is +2′.5; subsequently, 0′.0.

Dover circle 177.—Type (*a*); the property of the Department. It has been used extensively in Canada in 1906, Central America in 1907, Persia, Turkey in Asia and Europe, Arabia, Egypt, Asiatic Russia, Austria-Hungary, Germany, and England, in 1908 to 1910, and in Brazil and Peru since 1910. It has been, perhaps, the most satisfactory dip circle used by the Department. The corrections for the 1906 work in Canada, adopted from the comparison data then available, were: mean of needles Nos. 1 and 2, −1′.2; mean of needles Nos. 5 and 6, −1′.2; No. 3 deflected by No. 4, −1′.1, and No. 7 deflected by No. 8, −1′.6. The corrections adopted from a careful study of all the available data from comparisons with earth inductors available for observations and from a consideration of needle differences at field stations are as follows:

Dip	Needle No. 1	Needle No. 2	Needle No. 5	Needle No. 6
°	′	′	′	′
+ 0	−0.5	−0.3	−1.4	+0.6
+10	−0.5	−0.3	−1.2	+0.6
+20	−0.5	−0.3	−1.0	+0.5
+30	−0.7	−0.4	−0.8	+0.2
+40	−0.9	−0.4	−0.5	−0.1
+50	−1.1	−0.4	−0.2	−0.1
+60	−1.3	−0.2	−0.2	+0.2
+70	−1.2	−0.1	−0.7	−0.6

The tabular designation is 177·1256 or 177·125637.

The *corrections for declination values by compass attachment* are: prior to alterations during the first part of 1908, +1′.5; subsequently, +0′.6.

Dover circle 178.—Type (*a*); the property of the Department. It was used in Mexico for a few stations in 1906, by the *Galilee* during her cruises in 1906 to 1908, in Ecuador, Colombia, and Central America, 1908 to 1909, in Canada in 1910, and on the *Carnegie* during her first cruise in 1909 to 1910. For the Mexico work of 1906, the adopted corrections are: for the mean of needles Nos. 1 and 2, $-1'.5$; Nos. 5 and 6, $-1'.5$. The corrections resulting from a least square adjustment of the land intercomparisons of the *Galilee* work for use during 1907 and 1908 are given by the formulae:

Needle No. 1 $F\Delta I = -1'.8 + 3'.1 \cos I - 0'.2 \sin I$
Needle No. 2 $F\Delta I = -1.7 + 2.3 \cos I + 0.7 \sin I$
Mean, Nos. 1 and 2 $F\Delta I = -1.7 + 2.7 \cos I + 0.2 \sin I$
Needle No. 5 $F\Delta I = -3.0 + 3.4 \cos I$
Needle No. 6 $F\Delta I = -1.4 + 0.9 \cos I$
Mean, Nos. 5 and 6 $F\Delta I = -2.2 + 2.2 \cos I$

Upon the return of the instrument in June 1908, it was thoroughly overhauled. For the South and Central American work of 1908 and 1909, the corrections adopted from a least square adjustment of experimental and standard intercomparisons are given by the formulae:

Needle No. 1 $F\Delta I = +0'.2 + 0'.4 \cos I + 0'.5 \sin I$
Needle No. 2 $F\Delta I = +0.3 - 0.4 \cos I - 0.1 \sin I$
Mean, Nos. 1 and 2 $F\Delta I = +0.3 - 0.0 \cos I + 0.2 \sin I$
Needle No. 5 $F\Delta I = +0.2 - 1.0 \cos I + 0.3 \sin I$
Needle No. 6 $F\Delta I = +0.4 + 1.2 \cos I + 0.3 \sin I$
Mean, Nos. 5 and 6 $F\Delta I = +0.3 + 0.1 \cos I + 0.3 \sin I$

During the cruise of the *Carnegie* the needles all developed rust traces and pits so that very few available results were obtained, and the formulae for 1908 to 1909 had to be used. The tabular designation is 178·1256.

During July to October 1910, while the defective pivots of the regular dip needles of this circle were being renewed, some observations were made in Canada, using dip needles Nos. 5 and 6, and intensity needles Nos. 7 and 8 of circle 206. The corrections adopted for this work from intercomparisons with standard earth inductor are: needle No. 5 of 206, $-1'.0$; No. 6 of 206, $-2'.0$, and No. 7 of 206 deflected by No. 8, $-3'.0$. The tabular designation is 178·(567).

The *adopted corrections of declinations observed with the compass attachment* are: through June 1910, $+1'.2$; subsequently, after repairs to compass, $-3'.0$.

Lloyd-Creak Dover circle 189.—Type (*b*) as modified; the property of the Department; has two deflection distances and a telescope. It was used in the Pacific Ocean on the *Galilee* from July 1907 to the completion of her work in 1908 and during the latter part of 1908 in the Guianas, South America. The correction for the *Galilee* work as deduced by least square adjustments of the data from land intercomparisons are given by the formulae:

Needle No. 5 $F\Delta I = -0'.7 + 1'.6 \cos I - 2'.4 \sin I$
Needle No. 6 $F\Delta I = -1.1 + 2.1 \cos I - 1.2 \sin I$
Mean, Nos. 5 and 6 $F\Delta I = -0.9 + 1.9 \cos I - 1.8 \sin I$

Needle No. 3 deflected by No. 4 at long distance,

$F\Delta I = -1.5 - 1.3 \cos I - 0.2 \sin I$

Needle No. 3 deflected by No. 4 at short distance,

$F\Delta I = -3.7 + 1.3 \cos I + 2.4 \sin I$

Before the work in the Guianas was taken up the blades of needles No. 5 and No. 6 were polished so that only the formulae for needle No. 3 are used for that work; the corrections as adopted for the range of dip covered are: needle No. 5, $+10'.0$; No. 6, $-0'.2$; No. 9, $-1'.5$, and No. 10, $0'$. The tabular designation is 189·56 or 189·569·10.

This circle has been in use on the *Carnegie* since the inauguration of her work chiefly as an ocean instrument and but limited use for land work was made of it on the first cruise. For the latter purpose, chief reliance was put on land dip circle 201. Since the first cruise all land values obtained by the *Carnegie* are based on earth inductor No. 2 and land dip circle No. 201.

The correction adopted for the auxiliary land stations with 189 in 1909–10 was for mean of needles Nos. 9 and 10, $-2'.8$ for station near Falmouth, England, and $-2'.2$

Lloyd-Creak Dover circle 189—continued.

for the station at Spectacle Island, Bermuda; fuller information regarding the adopted corrections of the needles of 189 will be given in the report of the vessel's work. The tabular designation is 189·9·10.

The *adopted correction of declination values with the compass attachment* is +8′.5 for observations prior to July 1909, the mark being sighted with the peep sights; subsequent to overhauling of the instrument in 1909 the correction adopted is +6′—again for the peep sights.

Dover circle 201.—Type (*a*); the property of the Department. It was used during 1909 in Canada and subsequently has been a part of the land instrumental outfit of the *Carnegie*. This circle has been very satisfactory and the corrections of the dip needles have been well determined by means of extensive comparisons with earth inductor No. 2, also aboard the *Carnegie;* the following formulae have been adopted:

Needle No. 1 $F\Delta I = -0'.4 + 0'.9 \cos I - 0'.3 \sin I$

Needle No. 2 $F\Delta I = -1.9 + 2.6 \cos I + 0.4 \sin I$

Mean, Nos. 1 and 2 $F\Delta I = -1.2 + 1.7 \cos I$

The tabular designation is 201·12.

The *adopted correction of declinations observed with compass attachment* is −4′.6.

Dover circle 202.—Type (*a*); the property of the Department. It was used in Canada in 1909 and since then in Asiatic Turkey, Arabia, and Egypt. The corrections adopted from special experimental observations and from comparisons with earth inductors are:

Dip	Mean Needles Nos. 1 and 2	Mean Needles Nos. 5 and 6
°	′	′
+20	−0.4	−0.9
+40	−0.2	−0.5
+60	−0.1	−0.2
+80	+0.2	+0.7

The tabular designation is 202·1256.

The *adopted correction of declinations observed with the compass attachment* is: for work prior to August, 1910, +9′.5, and subsequently, −7′.5.

Lloyd-Creak Dover circle 203.—Type (*b*) as modified; the property of the Department. It has been a part of the *Carnegie* equipment as a reserve instrument. It has been used at only a few auxiliary land stations; the corrections adopted for these from intercomparisons with earth inductor 2 and circle 201 are: mean of needles No. 9 and No. 10 at the dip 67° north, −6′.9; at the dip 54° north, −4′.6 (needle No. 5, −5′.0). The tabular designation is 203·9·10.

Dover circle 206.—Type (*a*); the property of the Department. It was used in the United States in 1910, and since in China. The corrections adopted from earth inductor comparisons and needle differences for the dip 70° north are: mean needles Nos. 1 and 2, −0′.7; mean needles Nos. 5 and 6, −2′.2. The tabular designation is 206·1256.

The *adopted correction of observed declinations with the compass attachment* is +0′.4.

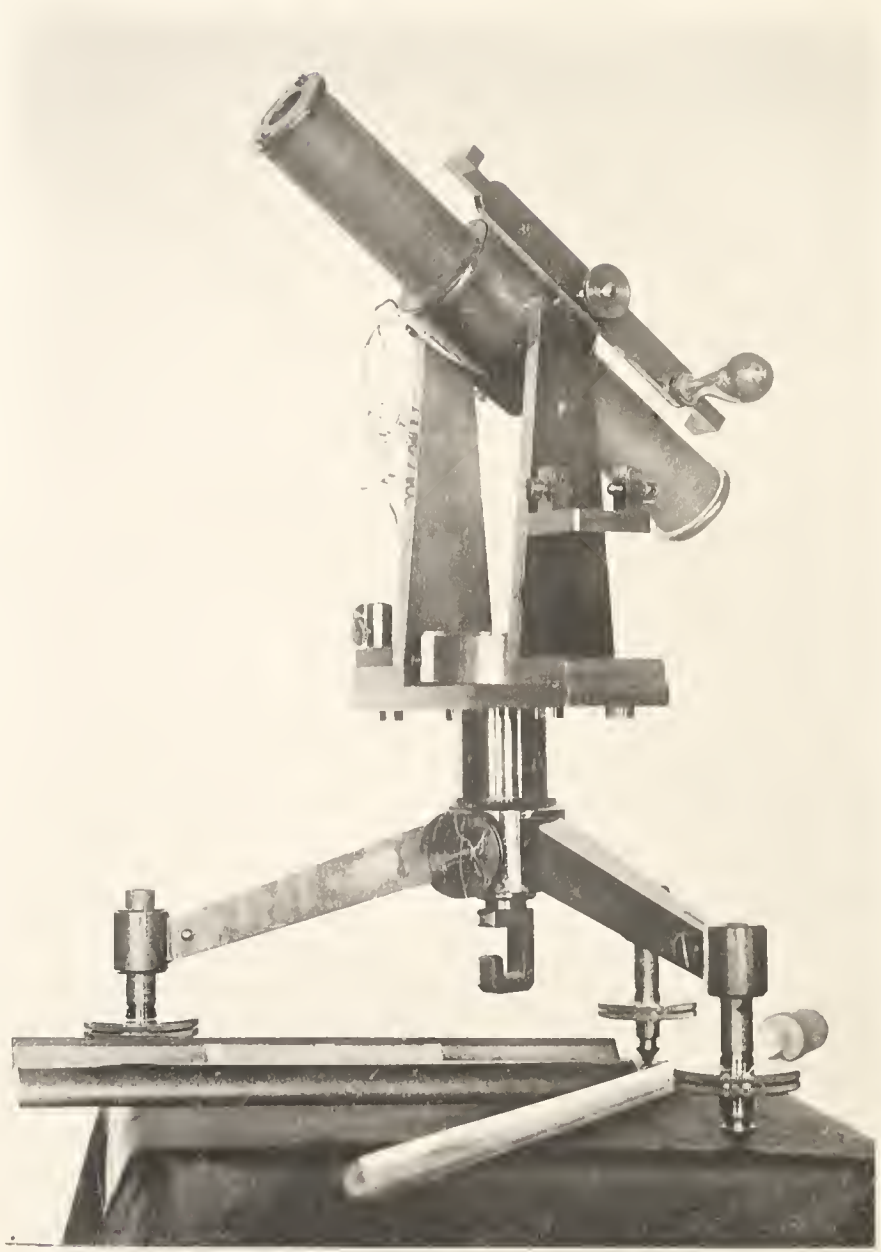
Tesdorpf circle 2025.—Type (*d*); the property of the Samoan Observatory; loaned the Department for work in Polynesia during 1906. The correction adopted for the range of dip covered, from comparisons at Apia and Christchurch, is: mean of needles Nos. 17 and 19, −1′.0. The tabular designation is 25·79.

Casella circle 4655.—Type (*a*); the property of the United States Coast and Geodetic Survey. It was used by the Department only at one station in the United States. The correction adopted for the mean of needles Nos. 3 and 4 is 0′.0. The tabular designation is 4655·34.

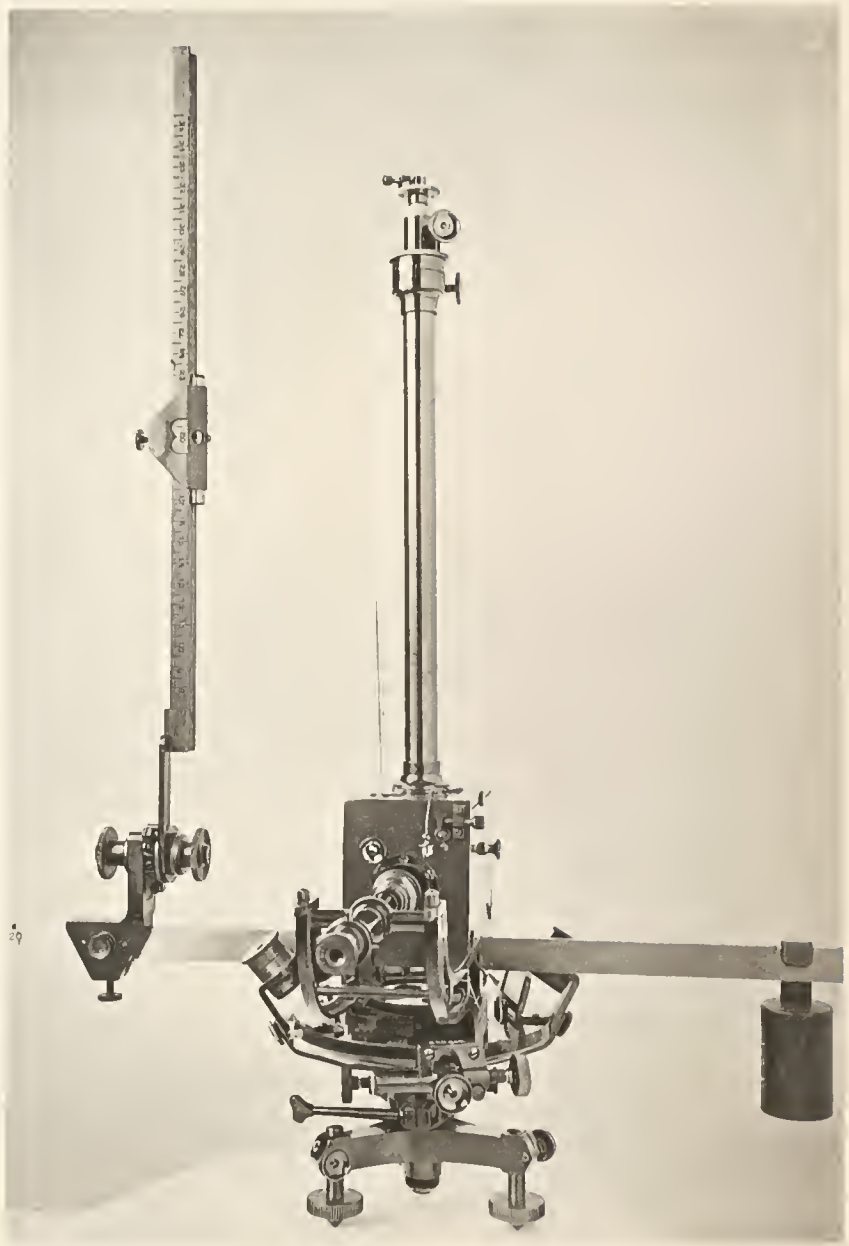
EARTH INDUCTOR CORRECTIONS TO STANDARD.

Earth inductor 48.—This earth inductor is of the Wild type as made by Schulze, and is the property of the Department. The adopted correction is −0′.5. The tabular designation is EI 48.

Earth inductor 2.—Same type as No. 48, except for some minor mechanical modifications; made by Toepfer and Son; the property of the Department. The correction to standard is −0′.5. The tabular designation is EI 2.



1. Induction Coefficient Apparatus for Weber's Method.



2. Induction Coefficient Apparatus for Lamont's Method.

RESULTS OF LAND MAGNETIC OBSERVATIONS, 1905–10.

Explanatory Remarks.

Few can realize the work involved in making a general magnetic survey of the Earth and the many questions which must be settled, at times wholly arbitrarily, not only in the work of organization, observation, and computation, but also in the final presentation and publication of the derived results in such a manner that all the varied purposes will be adequately served. Thus, for example, it has not been deemed advisable to attempt at present to apply corrections to the observed results on account of the numerous variations of the Earth's magnetism, *e. g.*, diurnal variation, secular variation, magnetic perturbations, etc. Instead, it is believed to be better to publish the observed results as obtained with no corrections applied except the reductions to the magnetic standards of the Department as fully explained in the section on this subject; thus undue delay is avoided in the promulgation of the results. The reduction to a common epoch can be undertaken more advantageously later, probably after 1913, when additional data have been secured. The reader will notice, however, that opposite the magnetic elements as tabulated in the Table of Results the precise date and local mean time of each observation are given; he is thus supplied with the required information in case, for some purpose of his own, it is necessary to reduce the observed values to some mean time.

Another question which had to be settled was the adoption of some sufficiently elastic scheme of tabulation. The following main divisions have been adopted for this volume: Africa, Asia, Australasia, Europe, North America, South America, Islands Atlantic Ocean, and Islands Pacific Ocean. Under each main division there are broad subdivisions; see Africa for example. The tabular entries under these subdivisions are in the order of decreasing north or increasing south latitude; that is to say, in the order of increasing co-latitude counting from the North Pole to the South. When there are stations of the same latitude, their order will be according to increasing east longitude, counting continuously from the standard meridian of Greenwich or zero to 360 degrees.

It seemed highly desirable not to have the complete entries for a station extend over one page; hence condensation and restriction to essential data became necessary. The question arose whether to give values of the horizontal intensity exclusively, or values of total intensity exclusively. While from a theoretical standpoint, it may appear preferable, if restriction must be made, to give the total intensity rather than the horizontal, the choice for practical reasons had to be made in favor of the latter. In the vast majority of cases, the horizontal intensity rather than the total was observed, and most likely will continue to be for some years at least. Only in high magnetic latitudes, where the horizontal intensity is small and hence its observation more or less difficult, were total intensities generally obtained. In the present publication rather than give total intensities, as derived by computation with the aid of the observed horizontal intensity and inclination, it was thought a better procedure to compute, in the considerably

smaller number of cases, the horizontal intensity from the observed total intensity and inclination, the so-obtained values being italicized in order to reveal their derivation.

It was also decided to publish the intensities in C. G. S. units, one C. G. S. unit being designated by capital gamma, Γ. In magnetic survey work the fourth decimal is often uncertain by one or more units and in ocean work the error may be five or more units in this decimal place. For these reasons it appears unadvisable in magnetic survey work to adopt so small a unit as a small gamma, $\gamma = 10^{-5}$ C. G. S. unit $= 10^{-5}\Gamma$; it would be necessary otherwise at times to round out the observed value by one or more zeros. This is avoided by the use of the larger unit; if the conditions under which an intensity result was obtained were such as not to warrant publishing the fourth or fifth decimal, this can be shown by stopping with the decimal deemed certain; some such cases will be found in the Table. In general, however, as will be seen, the value to the fifth decimal is given, but it should be understood that no claim is made for the correctness in all cases of the last figure; it has been retained here primarily in order that when all reductions to common epoch have been applied on account of the magnetic variations, an error of a unit in the fourth decimal, due purely to computation, will not enter.

The first column in the Table is headed "Station"; this gives the name of place at which the magnetic elements were observed, the spelling adopted being in accordance with the most reliable information at hand and conforming as far as possible to local usage. The next column gives the geographical position, latitudes and longitudes, as derived in most cases from the observer's local astronomical observations following the methods already described. When the latitudes are the result of fairly complete circummeridian observations of the Sun, or the mean of several re-occupations of the same station, or are derived from reliable large scale maps, then they are given to the nearest 0′.1, though it should be distinctly understood that this accuracy is not guaranteed, as even for these cases the error may be as much as 0′.5 and even in some instances a whole minute of arc. When the latitudes are given only to the nearest minute, there were either no astronomical determinations or they may have been incomplete or defective; these values are usually taken from standard atlases and for some regions may be in error by several minutes. Owing to the numerous sources of error of a longitude determination and especially because of the uncertainty in more or less unexplored countries of the adopted chronometer correction on standard time, the longitude in no instance is tabulated closer than to the nearest minute of arc. Usually it is derived from the observer's astronomical observations. Considerable use was also made of reliable large scale maps, whenever available, and of standard atlases; the values in regions but slightly surveyed may be out sometimes by several minutes.

The date on which the magnetic observations were made will be found in the fourth column. The following abbreviations have been adopted for the months of the year: Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec. The values of the magnetic elements will be found in the next columns as observed at the local mean time opposite each value and expressed to nearest 0.1 of an hour.

In cases where the observations which make up the mean value are numerous and scattered over the various parts of the day, so that the mean may be practically taken as the mean of day, the local mean times are replaced by the word "various." Occasionally it has appeared desirable, where diurnal variation in declination was observed or where numerous observations were made during a limited interval, to give the local mean times of the beginning and of the end of the series and to indicate the number of determinations from which the mean value is derived by a number inclosed in parentheses: thus $9^h.1$ to $11^h.3(7)$ is to be read "the mean is the result of seven determinations made during the interval $9^h.1$ to $11^h.3$, local mean time, inclusive"; $6^h.1$ to $20^h.3$ (d. v.) is to be read "eye readings of the suspended magnet were made regularly at short intervals from $6^h.1$ to $20^h.3$, local mean time." The local mean times are given according to civil reckoning and are counted from midnight as zero hour continuously through 24 hours; 16^h, for example, means 4 o'clock p. m.

The declination values, as also of inclination, are in general given in degrees, minutes, and tenths of minute of arc. For instruments which are not regarded as capable of yielding great accuracy only the nearest minute is given. In some cases the values are inclosed in parentheses, which serve to indicate that the value given is open to question owing to uncertainty of one kind or another. The tabulation of values of the horizontal intensity has already been explained above.

The instruments used are shown in the columns Mag'r (Magnetometer) and Dip Circle. Unless otherwise specified, when two instruments are given in the column of magnetometers, this implies that the first was used for declination observations and the second for horizontal intensity determinations. When the number of an instrument under magnetometer column is italicized, it means that a dip circle has been used in getting the declination by means of the compass attachment and that total instead of horizontal intensity was observed. A designation under the column Dip Circle, *e. g.*, 9.12 stands for "Dip circle No. 9, needles Nos. 1 and 2"; 142.1235, for "Dip circle No. 142, needles Nos. 1, 2, 3, 5"; 9.12(46), for "Dip circle No. 9, needles Nos. 1 and 2 of No. 9 and 4 and 6 of another circle," as explained in the section giving "Dip-circle Corrections."

In the last column the observer responsible for the observations is indicated by his initials. The observers engaged from time to time in the execution of the work given in this publication were as follows:

Land Magnetic Observers, 1905–10.

Observer	Designation	Observer	Designation	Observer	Designation
J. P. Ault	JPA	J. H. Egbert	JHE	J. C. Pearson	JCP
L. A. Bauer	LAB	H. W. Fisk	HWF	W. J. Peters	WJP
W. C. Bauer	WCB	J. A. Fleming	JAF	G. Peterson	GP
J. C. Beattie	JCB	H. D. Frary	HDF	J. F. Pratt	JFP
E. H. Bowen	EHB	C. G. Fuson	CGF	W. H. Sligh	WHS
J. E. Burbank	JEB	G. Heimbrod	GH	D. F. Smith	DFS
W. G. Cady	WGC	A. H. Homrighaus	AHH	D. C. Sowers	DCS
C. R. Carroll	CRC	G. L. Hosmer	GLH	C. C. Stewart	CCS
C. C. Craft	CCC	E. Kidson	EK	P. N. Swett	PNS
S. A. Deel	SAD	H. E. Martyn	HEM	R. R. Tafel	RRT
P. H. Dike	PHD	J. T. Morrison	JTM	P. C. Whitney	PCW
C. K. Edmunds	CKE	L. Palazzo	LP		

When observations were made jointly by two observers, this fact is shown by a combination of their last initials; thus for joint observations by Professors Beattie and Morrison, the designation B & M is used.

For the land observations secured by members of the ocean parties the following abbreviations have been used: G I, G II, and G III, meaning, respectively, first, second, and third cruises of the *Galilee*, and C I, and C II, meaning respectively, first and second cruises of the *Carnegie*. The observers on the various cruises of these vessels were as follows:

G I: J. F. Pratt, chief observer and commander; with Observers J. P. Ault, J. H. Egbert, and P. C. Whitney.
G II: W. J. Peters, chief observer and commander; with Observers J. P. Ault, H. E. Martyn, and J. C. Pearson.
G III: W. J. Peters, chief observer and commander; with Observers P. H. Dike, J. C. Pearson, G. Peterson, and D. C. Sowers.
C I: W. J. Peters, chief observer and commander; with Observers J. P. Ault, C. C. Craft, E. Kidson, D. F. Smith, and R. R. Tafel.
C II: W. J. Peters, chief observer and commander; with Observers C. C. Craft, C. R. Carroll, H. D. Frary, and E. Kidson.

It is impossible to refer to the observers individually in calling attention to the devotion, zeal, enthusiasm, and ability displayed in the successful accomplishment of duties well performed, at times under most adverse circumstances; in strange countries, amidst strange people with strange customs and speaking a strange language; often over infrequently traversed roads and even at times in regions either rarely or never before, as far as known, reached by white man; pursuing the work faithfully, even when revolution was rife in the countries visited and travel was attended with many dangers; following steadfastly in the direction of their goal at no little sacrifice of personal comfort and even sometimes at the risk of life and limb. They have carried on their work in nearly all the regions of the globe from latitude 78° North (Greenland) to 43½° South (New Zealand). Not only was meritorious work accomplished but owing to their care and good judgment, the vast amount of work, represented in skeleton by the "Summary of Results," was executed without a single loss of life; may equally good fortune attend future observers!

No small credit in these achievements is due to the hearty interest displayed and the very cordial and effective cooperation universally extended by the governing authorities and their representatives in countries where work was undertaken. Often the governing official has provided the observer with a personal escort to insure his safety to the next place of habitation; at times he has furnished him with fresh food, arranged for his lodging over night or given him special letters of recommendation to the next reigning official, etc., etc. Some idea of the courtesies thus received may be obtained from the observers' reports, given in part in a later section.

But while too much credit can not be given the observers for their part of the work, those who have labored ably and faithfully at the Office in the reduction and preparation for publication should not be overlooked. Although the observers

themselves when returning from the field have frequently taken their turn in making the final office computations of each other's observations, the chief burden has been borne by the following members of the Office personnel: J. A. Fleming, magnetician-in-charge, H. W. Fisk and J. P. Ault, magneticians, and J. H. Millsaps and Miss E. L. Beehler, clerks. Owing to the Director's inspection trip of 1911, the preparation of this volume in a very large measure had to be intrusted to Mr. Fleming. Mention should also be made of the efficient services rendered by the chief mechanician, J. A. Widmer, in the construction and repair of instruments.

DISTRIBUTION OF STATIONS.

Some idea of the extent of the land work represented in the Table of Results may be obtained from the synopsis given in Table 5, showing the geographical distribution of the stations occupied during the six years 1905–1910. Data have been secured in each continent, as also on the numerous islands in the Pacific and Atlantic Oceans. It will be seen that the work was chiefly done in the regions of Africa, Asia, and North and South America, and on the islands in the Pacific Ocean where magnetic data are most required. Since 1910 other countries have been surveyed and additional stations have been obtained in some of the previous

TABLE 5.—*Summary showing the Geographical Distribution of Magnetic Stations, 1905–10.*

Countries and subdivisions	No. of different stations	C. I. W. repeat stations	Totals by country	Countries and subdivisions	No. of different stations	C. I. W. repeat stations	Totals by country
Africa	.....	.....	386	North America	.....	.....	328
Belgian Congo	6	.....		Canada	162	14	
British East Africa	29	.....		Central America	59	5	
British South and Central Africa	165	2		Greenland	9	.....	
Egypt	9	2		Mexico	19	.....	
German East Africa	69	.....		Newfoundland (including Labrador)	27	4	
German Southwest Africa	67	1		United States (including Alaska)	52	12	
Portuguese East Africa	7	.....			.....	.....	
Tripoli	1	.....					
Uganda	33	.....		South America	.....	.....	111
				Brazil	24	.....	
				Colombia	23	2	
Asia	.....	.....	308	Ecuador	11	.....	
Asiatic Russia	32	.....		Guiana	31	1	
China	142	6		Peru	21	.....	
Cyprus	1	.....		Venezuela	1	.....	
India	9	.....					
Japan	6	.....		Islands Atlantic Ocean	.....	.....	68
Persia	37	.....		Bermudas	9	2	
Turkish Empire	81	2		Madeiras	4	.....	
				West Indies	55	5	
				Islands Pacific Ocean	.....	.....	51
Australasia	.....	.....	10	Caroline Islands	3	.....	
Australia	3	.....		Cook Islands	2	.....	
New Zealand	7	1		Fanning Island	2	1	
				Fiji Islands	10	1	
				Hawaiian Islands	3	1	
Europe	.....	.....	36	Ladrone Islands	4	.....	
Austria-Hungary	1	.....		Marquesas Islands	6	.....	
Germany	1	.....		Marshall Islands	5	1	
Great Britain	5	1		Samoan Islands	5	1	
European Russia	22	2		Society Islands	9	1	
Turkish Empire	7	1		Tuamotu Islands	2	.....	

regions; it is the hope that with the effective cooperation of the existing magnetic institutions, sufficient data on land and ocean will be available to make possible some time after 1913 the construction of new magnetic charts for the epoch 1910. The total number of different stations occupied during the six years' work embraced in the present publication and as shown by Table 5 is 1298, of which 69, however, have been reoccupied more than once in order to obtain secular variation data; thus the total number of actual occupations of primary points has been 1391. Furthermore, more or less extensive magnetic observations were made at over 100 auxiliary stations, some of which were established in connection with standardizations or determination of instrumental constants; most of them, however, were for the purpose of investigations of local disturbances—thus there were about 80 of these in the Bermudas and about 25 in the vicinity of the local magnetic pole near Treadwell, Alaska. The grand total of occupations of magnetic stations on land between 1905 and 1910 was, accordingly, about 1500, or on the average, about 250 per annum. Out of the total number there are but 102 for which, owing to some reason, the magnetic observations were not quite complete; that is to say, not all three elements were secured. These were chiefly secondary or auxiliary stations, the element most generally lacking being, of course, the declination because of failure to secure azimuth determinations on account of overcast skies.

In addition to the 69 C. I. W. secular variation stations, there were re-occupied about 125 other points at which the magnetic elements had been observed previously by other organizations or observers, thus not only furnishing additional secular variation data, but also the data required if use is to be made of previous magnetic operations. It is the endeavor to secure secular variation and correlation data at about 10 to 20 per cent of the points occupied each year. Thus the distribution and the secular variation work are being prosecuted together. Twenty-three of the stations have been at magnetic observatories very widely scattered over the Earth from which the data for correlation of magnetic standards of all countries have been obtained.

It may also be mentioned that in cooperation with other organizations, in particular with governmental institutions in Mexico and in Canada, the Department has furnished instrumental and other assistance and has thus aided in the securing of magnetic data which will be published by the respective institutions concerned. Thus, for example, a cooperative arrangement was entered into in 1908 with the Canadian Department of Marine and Fisheries for securing magnetic and allied observations on an eighteen months' cruise of the *Arctic* (formerly the *Gauss*), commanded by Capt. J. E. Bernier, to Baffin Land, Davis Strait, Lancaster Sound, Barrow Strait, and Melville Sound. The Department supplied the outfit of magnetic and electric instruments, gave such additional training to the observer of the Canadian Meteorological Service, Mr. W. E. W. Jackson, at Washington, as he required, and furnished all necessary observation forms and data, as also full directions for the work, which was confined chiefly to work ashore and on the ice.

1. View from the Station at Chiche, Guatemala.

2. Mount Ometepec, Nicaragua.

3. Station near North Rock, Bermuda, at low water.

4. View of Station at Glacier, British Columbia.

5. View of Station at Nelly Island, Bermuda.

6. Looking South from the Station at St. Johns, Antigua, West Indies.

Typical Field Views by Observers in British Columbia, Central America, the West Indies, and the Bermudas.

SPECIAL LAND INVESTIGATIONS.

In addition to the land work, contained in the Table of Results, there have also been secured results from the above-mentioned two detailed magnetic surveys made for the study of local magnetic disturbances, *viz.*, by H. W. Fisk in the Bermudas and by L. A. Bauer near the local magnetic pole at Treadwell, Alaska; these results will be given in a later publication.

Special observations by members and associates of the Department in terrestrial magnetism and in atmospheric electricity were made during the total solar eclipse of August 30, 1905, at Missinaibi, Canada (L. A. Bauer and W. C. Bauer); West Turnavik, Labrador (G. L. Hosmer); Battle Harbor, Labrador (J. E. Burbank, E. H. Bowen, and A. H. Homrighaus); Black Point, Nova Scotia (W. G. Cady); Palma, Spain (Professors Elster, Geitel, and Harms); and Tripoli, Barbary (Professors Palazzo and Oddone). The following articles with reference to the special instrumental outfits and apparatus, as well as the results of some of this work, have already appeared in the *Journal of Terrestrial Magnetism and Atmospheric Electricity:* Atmospheric electric observations at Battle Harbor, The Labrador, during the total solar eclipse of August 30, 1905, by J. E. Burbank, v. 12, 1907, pages 97–104; A direct recording declinograph, by W. G. Cady, v. 11, 1906, pages 145–153 (this instrument was used by Dr. Cady at Black Point, Nova Scotia); Vorschläge für die Ausfuhrung electrischer Beobachtungen während der bevorstehenden Sonnenfinsternis, by J. Elster and H. Geitel, v. 10, 1905 (17–20); Luftelektrische und photometrische Beobachtungen während der totalen Sonnenfinsternis 30 August, 1905, by J. Elster, H. Geitel, and F. Harms, v. 11, 1906 (1–44); Magnetic elements determined at Tripoli, Barbary, by L. Palazzo, v. 11, 1906 (93–96); Measurements of the electric potential during the total solar eclipse of August 30, 1905, at Tripoli, Barbary, by E. Oddone, v. 11, 1906 (167–180).

Some other land observations in terrestrial magnetism and atmospheric electricity have been made in connection with the following investigations already published in the *Journal of Terrestrial Magnetism and Atmospheric Electricity, viz.*, Is the Earth's action on a magnet only a couple? by L. A. Bauer, v. 13, 1908 (25–35); On the apparent alteration of mass disclosed by weighings of magnets, by L. A. Bauer, v. 14, 1909 (72–76); The diurnal variation of the amount of radioactive emanation in the atmosphere, by P. H. Dike, v. 11, 1906 (126–129); Some atmospheric radioactive observations made at Washington, D. C., showing the presence of thorium in the air, by J. E. Burbank, v. 11, 1906 (105–107).

RESULTS OF LAND MAGNETIC OBSERVATIONS, 1905–10

AFRICA.

Belgian Congo.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
JCB 111 & JTM 50	12 21.1 S	29 33	May 25,'09	14.8, 16.5, 17.0	12 45.8 W	15.5	45 26.3 S	15.8	.24648	73	9.12	B&M
JCB 110 & JTM 49	12 30.0 S	29 31	May 24, 09	14.4, 16.9	12 57.9 W	15.0	45 47.6 S	15.6	.24573	31	142.1235	B&M
JCB 109 & JTM 48	12 31.1 S	29 20	May 23, 09	13.8, 15.8, 16.6	12 46.1 W	15.0	45 48.1 S	14.8	.24439	73	9.12	B&M
JCB 108 & JTM 47	12 38.1 S	29 12	May 22, 09	14.3, 14.7	13 02.0 W	14.5	45 46.9 S	15.4	.24409	31	142.235	B&M
JCB 107 & JTM 46	12 46.5 S	29 06	May 21, 09	13.9, 16.0, 16.3	13 06.0 W	15.3	45 56.4 S	15.0	.24351	73	9.12	B&M
JCB 106 & JTM 45	12 51.4 S	28 56	May 20, 09	14.1, 16.5	13 00.4 W	13.8	45 52.1 S	15.2	.24325	31	142.235	B&M

British East Africa.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Kibigori	0 04.5 S	35 06	Oct 26,'09	12.2, 14.6	5 55.6 W	16.6	23 59.6 S	13.8	.31507	31	9.12(46)	JTM
Port Florence	0 05.7 S	34 45	Oct 25, 09	13.4, 15.4	5 58.6 W	16.8	23 46.4 S	14.6	.31579	31	9.12(46)	JTM
Londiani	0 09.9 S	35 38	Oct 30, 09	8.3, 10.7	5 40.3 W	12.4	24 01.7 S	9.9	.31593	31	9.12(46)	JTM
			Oct 30, 09	14.9, 17.3	5 41.0 W	.....	.....	.....	.....	31	.....	JTM
Lumbwa	0 10 S	35 30	Oct 28, 09	15.8	5 57.3 W	.....	.....	16.6	.31429	31	.....	JTM
			Oct 29, 09	9.5	5 56.6 W	10.7	24 00.4 S	.....	.....	31	9.2(46)	JTM
Fort Ternan	0 13.0 S	35 23	Oct 27, 09	11.2	6 03.5 W	.....	.....	12.4	.31437	31	.....	JTM
			Oct 28, 09	7.3	6 06.8 W	8.6	24 04.6 S	.....	.....	31	9.(46)	JTM
Elhurgon	0 17 S	36 00	Nov 1, 09	9.6, 11.1	5 44.8 W	16.8	24 23.1 S	10.4	.31525	31	9.12(46)	JTM
Nakuru	0 17.2 S	36 11	Nov 2, 09	11.5, 14.3	5 41.8 W	15.8	24 29.3 S	12.5	.31441	31	9.1(46)	JTM
Elmenteita	0 29.6 S	36 15	Nov 3, 09	10.6, 13.8	5 23.0 W	15.0	24 34.4 S	11.5	.31471	31	9.12(46)	JTM
Gilgil	0 30.1 S	36 20	Nov 5, 09	8.9, 10.7	5 34.0 W	12.8	25 09.7 S	10.0	.31397	31	9.12(46)	JTM
Naivasha	0 43.0 S	36 30	Nov 6, 09	10.3, 12.1, 15.4	5 32.6 W	16.8	25 24.4 S	11.1	.31601	31	9.12(46)	JTM
Kijabé	0 56.0 S	36 38	Nov 7, 09	15.2	5 59.9 W	16.4	25 59.8 S	15.5	.31368	31	9.12	JTM
Lamoru	1 07.4 S	36 44	Nov 8, 09	10.0, 11.9	5 20.8 W	14.7	25 54.9 S	10.8	.31464	31	9.12(46)	JTM
Nairobi	1 17.2 S	36 46	Nov 9, 09	16.4	5 45.8 W	.....	.....	.....	.....	31	.....	JTM
			Nov 10, 09	12.2, 17.4	5 45.4 W	.....	.....	13.1	.30974	31	.....	JTM
			Nov 11, 09	.....	.....	7.3	26 35.5 S	.....	.....	..	9.12	JTM
Athi River	1 27.0 S	36 58	Nov 11, 09	13.6, 16.7	5 43.3 W	17.7	26 59.1 S	15.1	.31095	31	9.1	JTM
Kapiti	1 42.1 S	37 11	Nov 12, 09	11.3, 14.8	5 40.3 W	15.8	27 24.2 S	12.7	.30991	31	9.12(6)	JTM
Kiu	1 54.1 S	37 11	Nov 13, 09	9.8, 11.3	5 46.8 W	12.7	27 44.9 S	10.6	.30912	31	9.12(6)	JTM
Sultan Hamud	2 01.4 S	37 32	Nov 15, 09	10.5, 12.2	5 41.8 W	14.8	28 52.2 S	11.2	.30781	31	9.12	JTM
Simba*	2 09.6 S	37 36	Nov 16, 09	9.8, 11.4	4 41.6 W	14.7	28 00.3 S	10.6	.30643	31	9.12(6)	JTM
Makindu	2 16.8 S	37 47	Nov 17, 09	10.6, 16.7	5 36.8 W	17.3	28 53.8 S	10.9, 14.8	.30706	31	9.12(46)	JTM
Masongaleni	2 29.2 S	37 57	Nov 18, 09	11.0, 14.1	5 39.0 W	15.0	29 00.1 S	12.1	.30679	31	9.12(6)	JTM
Mtito Andei	2 41.3 S	38 08	Nov 19, 09	10.0, 12.4	5 40.1 W	16.6	29 25.2 S	11.3	.30575	31	9.1(6)	JTM
Tsavo	2 59.6 S	38 28	Nov 20, 09	10.2, 12.3	5 37.8 W	15.5	29 55.3 S	11.1	.30475	31	9.12(6)	JTM
Voi	3 23.6 S	38 34	Nov 22, 09	9.3, 10.8	5 46.6 W	12.1	30 45.7 S	10.1	.30418	31	9.12(46)	JTM
Maungu	3 33.2 S	38 42	Nov 23, 09	8.9, 10.4	5 28.2 W	11.8	31 02.1 S	9.7	.30247	31	9.12(46)	JTM
Mackinnon	3 44.0 S	39 01	Nov 24, 09	11.0, 13.0	5 38.9 W	15.4	31 27.2 S	12.1	.30147	31	9.12(46)	JTM
Samburu	3 46.4 S	39 16	Nov 25, 09	9.8, 11.2	5 34.8 W	14.3	31 40.5 S	10.5	.30122	31	9.12(46)	JTM
Mazeras	3 58.0 S	39 36	Nov 26, 09	13.5, 14.1	5 30.1 W	15.5	31 55.4 S	13.8	.30033	31	9.1(6)	JTM
English Pt., Mombasa	4 04 S	39 20	Oct 21, 09	13.5, 15.9	5 35.8 W	17.1	32 06.2 S	14.4	.30033	31	9.12(46)	JTM
Zanzibar	6 09 S	39 14	Sep 26, 09	.....	.....	10.9	36 17.8 S	12.0	.28705	31	9.12(46)	JTM

British South and Central Africa.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Abercorn	8 49.5 S	31 24	Jul 5,'09	.....	.....	10.4, 11.8	40 29.6 S	.....	.....	..	142.1235	B&M
			Jul 6, 09	10.0 to 12.6(8)	10 23.2 W	.....	.....	15.4	.26642	73	.....	B&M
			Jul 6, 09	14.4, 14.6, 14.9	10 17.7 W	.....	.....	.....	.....	31	.....	B&M
Abercorn, B	8 49.5 S	31 24	Jul 6, 09	10.4 to 11.5(4)	10 23.4 W	.....	.....	.....	.....	31	.....	B&M
			Jul 6, 09	14.4 to 15.1(4)	10 18.0 W	.....	.....	.....	.....	73	.....	B&M
JTM 79	8 50.2 S	31 29	Jul 10, 09	11.3, 13.7	10 26.0 W	15.2	40 20.9 S	12.7	.26767	31	9.12(46)	JTM
JCB 137 & JTM 76	8 52.4 S	30 58	Jun 30, 09	13.8, 16.9	10 30.4 W	15.2	40 22.7 S	.....	.....	31	9.12(46)	B&M
			Jun 30, 09	.....	.....	16.5	40 22.6 S	14.4	.26638	73	142.1235	B&M
JCB 136 & JTM 75	8 52.7 S	30 44	Jun 29, 09	.....	.....	16.2	40 17.8 S	14.0	.26581	31	9.12(46)	B&M
			Jun 29, 09	13.7, 14.9	10 38.4 W	.....	.....	.....	.....	73	.....	B&M
JCB 138 & JTM 77	8 55.5 S	31 11	Jul 1, 09	.....	.....	17.2	40 27.0 S	15.4	.26697	31	9.12(46)	B&M
			Jul 1, 09	14.6, 15.3	10 22.6 W	.....	.....	.....	.....	73	.....	B&M
JTM 80	8 57.2 S	31 44	Jul 12, 09	10.3, 13.0	10 23.6 W	14.1	40 19.1 S	11.8	.26710	31	9.12(46)	JTM
JCB 135 & JTM 74	8 57.3 S	30 31	Jun 28, 09	13.5, 15.8, 17.0	10 39.8 W	14.8	40 29.2 S	.....	.....	31	9.12(46)	B&M
			Jun 28, 09	.....	.....	15.5, 16.8	40 29.3 S	13.8	.26402	73	142.1235	B&M
JTM 81	9 01.4 S	31 57	Jul 13, 09	10.5, 13.4	10 18.2 W	14.3	41 03.0 S	12.3	.26647	31	9.12(46)	JTM
JTM 82	9 05.9 S	32 09	Jul 14, 09	10.2, 13.0	10 24.0 W	14.3	40 41.6 S	11.4	.26746	31	9.12(46)	JTM

* Local disturbance.

AFRICA.

BRITISH SOUTH AND CENTRAL AFRICA—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
JCB 134 & JTM 73	9 08.1 S	30 27	Jun 27,'09	.....	.....	14.4	40 21.4 S	16.2	.26436	31	9.12(46)	B&M
			Jun 27, 09	13.2, 14.7, 16.8	10 40.1 W	.....	.....	.....	.....	73	.....	B&M
JTM 83	9 09.7 S	32 19	Jul 15, 09	10.0, 11.9	10 32.4 W	13.6	40 48.8 S	11.1	.26807	31	9.12(46)	JTM
Chumbie's Kraal (JCB 133 & JTM 72)	9 15.0 S	30 20	Jun 26, 09	15.7, 16.6	10 42.5 W	14.5	40 33.5 S	16.8	.26488	31	9.12(46)	B&M
			Jun 26, 09	.....	.....	14.6	40 34.2 S	16.2	.26480	73	142.1235	B&M
JTM 84	9 16.0 S	32 31	Jul 16, 09	10.3, 12.8	10 04.0 W	14.0	41 13.1 S	11.6	.26573	31	9.12(46)	JTM
Fife	9 20.0 S	32 47	Jul 17, 09	17.8	10 12.8 W	.....	.....	.....	.....	31	.....	JTM
			Jul 18, 09	9.2	10 14.1 W	11.7	41 11.2 S	8.1	.26660	31	9.12(46)	JTM
Mporokoso (JCB 132 & JTM 71)	9 21.9 S	30 10	Jun 25, 09	15.1, 16.2, 16.7	10 56.5 W	14.1	40 54.0 S	.....	.....	73	142.1235	B&M
			Jun 25, 09	.....	.....	14.3	40 53.7 S	16.2	.26376	31	9.12(46)	B&M
Luangwa River	9 31.1 S	30 16	Jun 24, 09	15.3, 16.8	10 57.2 W	13.5	41 10.6 S	.....	.....	31	142.1235	B&M
			Jun 24, 09	16.7	10 57.5 W	14.0	41 10.9 S	15.8	.26274	73	9.12(46)	B&M
JTM 86	9 31.4 S	32 54	Jul 19, 09	10.1, 12.4	9 52.8 W	13.8	42 21.9 S	11.1	.26149	31	9.12(46)	JTM
JTM 87	9 39.1 S	33 05	Jul 20, 09	10.5, 12.6	10 27.2 W	13.8	41 25.0 S	11.4	.26337	31	9.12(46)	JTM
JCB 130 & JTM 69	9 39.6 S	30 22	Jun 23, 09	15.0, 15.7, 16.4	11 02.7 W	14.0	41 14.8 S	.....	.....	73	142.1235	B&M
			Jun 23, 09	.....	.....	14.1	41 14.2 S	16.0	.26261	31	9.12(46)	B&M
Fort Hill	9 41.9 S	33 17	Jul 21, 09	10.8, 13.2	10 17.7 W	14.3	41 36.0 S	11.8	.26411	31	9.12(46)	JTM
JTM 89	9 46.9 S	33 29	Jul 22, 09	10.0, 11.9	9 54.0 W	14.4	41 44.4 S	11.2	.26545	31	9.12(46)	JTM
JCB 129 & JTM 68	9 50.5 S	30 27	Jun 22, 09	13.9	11 01.3 W	16.5	41 41.2 S	15.0	.26187	73	142.1235	B&M
			Jun 22, 09	13.9, 17.5	11 01.6 W	16.5	41 41.2 S	.....	.....	31	9.12(46)	B&M
JTM 90	9 53.1 S	33 40	Jul 23, 09	10.8, 13.1	10 08.3 W	14.2	42 22.6 S	12.1	.26354	31	9.12(46)	JTM
Karonga	9 55.4 S	33 57	Jul 24, 09	14.6	10 13.4 W	.....	.....	.....	.....	31	.....	JTM
JTM 92	10 00 S	33 58	Jul 26, 09	.....	.....	17.5	42 50.5 S	16.3	.26141	31	9.12	JTM
JCB 128 & JTM 67	10 02.9 S	30 24	Jun 21, 09	14.4, 15.1	11 13.3 W	16.0	41 52.6 S	.....	.....	73	9.12(46)	B&M
			Jun 21, 09	.....	.....	.....	.....	14.1	.26193	31	.....	B&M
JCB 127 & JTM 66	10 07.6 S	30 15	Jun 20, 09	13.6, 17.1	11 27.2 W	14.6	42 01.2 S	.....	.....	31	142.1235	B&M
			Jun 20, 09	13.6	11 24.2 W	14.8	42 00.9 S	16.0	.26211	73	9.12(46)	B&M
JTM 93	10 08.0 S	34 03	Jul 27, 09	10.7, 13.0	10 06.4 W	14.2	42 31.8 S	12.0	.26167	31	9.12(4)	JTM
JCB 126 & JTM 65	10 11.7 S	30 06	Jun 19, 09	14.5, 15.5, 17.3	11 22.1 W	15.0	42 05.1 S	.....	.....	73	9.12(46)	B&M
			Jun 19, 09	.....	.....	.....	.....	17.0	.25986	31	.....	B&M
Luwingu (JCB 125 & JTM 64)	10 14.7 S	29 57	Jun 14, 09	9.4 to 17.4(10)	11 26.9 W	10.9	42 09.0 S	12.0	.25950	73	9.12(46)	B&M
			Jun 15, 09	.....	.....	Various(7)	42 12.1 S	.....	.....	..	142 & 9	B&M
			Jun 16, 09	9.9 to 15.3(7)	11 29.0 W	.....	.....	.....	.....	73	.....	B&M
JTM 94	10 16.1 S	34 08	Jul 29, 09	8.8, 11.0	10 13.3 W	12.3	42 48.6 S	10.3	.26159	31	9.12(46)	JTM
JCB 124 & JTM 63	10 24.9 S	29 45	Jun 12, 09	13.4, 15.3	11 31.1 W	14.8, 17.1	42 38.0 S	16.8	.25792	31	142.1235	B&M
			Jun 12, 09	.....	.....	14.6	42 37.0 S	.....	.....	..	9.12	B&M
JCB 123 & JTM 62	10 29.2 S	29 32	Jun 11, 09	13.2, 15.5	11 57.6 W	14.2	42 38.3 S	14.3	.25900	73	9.12(6)	B&M
JTM 95	10 32.8 S	34 12	Jul 30, 09	10.6, 12.8	9 49.8 W	13.8	42 54.6 S	11.7	.26074	31	9.12(46)	JTM
Livingstonia	10 36.1 S	34 07	Jul 31, 09	.....	.....	8.4	42 48.6 S	14.8	.26226	31	9.12(46)	JTM
JCB 122 & JTM 61	10 38.7 S	29 22	Jun 10, 09	12.9, 14.6, 16.6	12 09.9 W	13.9	42 42.0 S	15.6	.25933	31	9.12	B&M
			Jun 10, 09	.....	.....	13.9	42 43.1 S	.....	.....	..	142.1235	B&M
JCB 121 & JTM 60	10 47.6 S	29 13	Jun 9, 09	14.8, 16.1	11 49.7 W	14.5	43 10.1 S	15.5	.25712	73	9.12	B&M
JTM 97	10 50.0 S	34 01	Aug 2, 09	10.1, 12.5	11 24.4 W	13.6	43 54.0 S	11.3	.25842	31	9.12(46)	JTM
JCB 120 & JTM 59	11 00.0 S	29 06	Jun 8, 09	13.8, 15.8	12 34.6 W	14.5	43 07.4 S	14.9	.25546	31	142.1235	B&M
JTM 98	11 04.7 S	33 54	Aug 3, 09	11.6, 12.8	9 57.1 W	13.9	44 16.7 S	11.6	.25728	31	9.12(46)	JTM
Fort Rosebery (JCB 119)	11 11.3 S	28 57	Jun 4, 09	19.0 to	12 34.5 W	.....	.....	.....	.....	73	.....	JCB
			Jun 5, 09	9.0 (d. v.)		.....	.....	.....	.....	73	.....	JCB
			Jun 5, 09	.....	.....	.....	.....	12.2, 15.5	.25456	73	.....	JCB
			Jun 5, 09	.....	.....	.....	.....	16.5	.25441	73	.....	JCB
			Jun 6, 09	.....	.....	8.9, 11.0	43 18.5 S	.....	.....	..	142.12	JCB
			Jun 6, 09	.....	.....	12.5, 16.1	43 20.0 S	.....	.....	..	142.12	JCB
			Jun 7, 09	.....	.....	11.9, 12.7	43 17.0 S	.....	.....	..	142.35	JCB
Fort Rosebery (JTM 58)	11 11.3 S	28 57	Jun 4, 09	11.0 to	12 35.6 W	.....	.....	.....	.....	31	.....	JTM
			Jun 5, 09	10.0 (d. v.)		.....	.....	.....	.....	31	.....	JTM
			Jun 5, 09	.....	.....	.....	.....	12.3, 15.6	.25461	31	.....	JTM
			Jun 5, 09	.....	.....	.....	.....	16.6	.25447	31	.....	JTM
			Jun 6, 09	.....	.....	8.9, 11.0	43 19.2 S	.....	.....	..	9.12	JTM
			Jun 6, 09	.....	.....	12.7, 16.2	43 19.0 S	.....	.....	..	9.12	JTM
			Jun 7, 09	.....	.....	12.0, 12.7	43 17.2 S	.....	.....	..	9.12	JTM
JCB 118 & JTM 57	11 18.2 S	29 03	Jun 1, 09	14.1, 16.1	12 04.2 W	14.1, 14.9	43 42.4 S	15.1	.25397	31	142.12	B&M
JTM 99	11 20.1 S	33 49	Aug 4, 09	10.2, 12.5	11 24.4 W	13.6	44 12.9 S	11.0	.26050	31	9.12(46)	JTM
JCB 117 & JTM 56	11 27.0 S	29 10	May 31, 09	14.5, 16.9	12 38.4 W	14.8	43 38.0 S	15.7	.25339	73	9.12	B&M
JTM 100	11 33.2 S	33 41	Aug 5, 09	9.8, 11.8	11 04.4 W	13.3	44 28.8 S	10.8	.25384	31	9.12(46)	JTM
JCB 116 & JTM 55	11 37.4 S	29 15	May 30, 09	14.3	12 51.1 W	14.0, 16.4	44 59.4 S	15.5	.24760	31	142.1235	B&M

AFRICA

BRITISH SOUTH AND CENTRAL AFRICA—*Continued.*

Station	Latitude	Long. East + W.	Date	Declination			Inclination		Hor. Intensity		Instruments		Observer
				Local Mean Time	Value		L. M. T.	Value	L. M. T.	Value	Magnet	Dip Circle	
	° ′	° ′		h m s	° ′		h m s	° ′	h m s				
[illegible]	46.2 S	29 —	May 29, 09	—.—	32 8.3	W	5.1	45 55.9	5.1	24481	72	1.02	BEM
[illegible]	28.— S	30 —	Aug. 2, 09	10.7 —.—	31 57.3	W	—.—	— 45.3	—.—	25237	71	1.02/46	JTM
[illegible]	30.2 S	29 —	May 28, 09	10.4 —.— —.—	32 —.—	W	4.1	45 12.1	—.—	24888	71	—.—/—	BEM
[illegible]	29.2 S	30 —	Aug. 1, 09	10.1 —.—	31 51.7	W	5.1	45 10.3	10.3	25278	71	1.02/46	JTM
[illegible]	28.— S	29 —	May 27, 09	—.— —.— —.—	32 10.1	W	5.1	— 49.1	5.7	25137	70	1.02	BEM
Sunnyvale	28.— S	29 —	May 26, 09	—.— 10.7	32 —.—	W	—.—	45 28.—	—.—	24664	71	—.—/—	BEM
[illegible]	28.— S	28 —	Aug. 1, 09	10.—	32 —.—	W	—.—	45 29.4	—.—	24844	71	1.02	JTM
[illegible]	28.— S	28 —	Aug. 1, 09	10.1	32 —.—	W	—.—	45 29.4	—.—	24846	71	1.02/46	JTM
[illegible]	28.4 S	28 —	Aug. — 09	10.1 —.—	32 10.1	W	—.—	45 29.1	—.—	24877	71	1.02/46	JTM
[illegible]	27.— S	28 —	May 29, 09	10.7 —.— —.—	32 —.—	W	—.—	45 29.2	—.—	24876	70	1.02	BEM
Vryburg	26.0 S	24 —	May 25, 09	11.1	32 10.—	W	—.—	45 24.—	—.—	24585	71	—.—/—	BEM
[illegible]	26.— S	24 —	Aug. 1, 09	10.1 —.—	32 —.—	W	—.—	45 24.4	—.—	24877	71	1.02/46	JTM
[illegible]	26.— S	25 —	May 24, 09	10.7 —.—	32 —.—	W	—.—	45 24.1	—.—	24845	70	1.02	BEM
Vryburg	26.— S	24 —	Aug. 1, 09	11.— —.—	32 —.—	W	—.—	45 24.—	—.—	24878	71	1.02/46	JTM
[illegible]	27.— S	24 —	May 23, 09	11.—	32 —.—	W	—.—	45 24.—	—.—	24845	70	—.—/—	BEM
[illegible]	27.— S	24 —	May 22, 09	—.— —.— —.—	32 15.1	W	—.—	45 24.—	—.—	24845	70	1.02	BEM
[illegible]	26.— S	24 —	Aug. 28, 09	—.—	32 —.—	W	—.—	45 24.—	—.—	24845	71	1.02/46	JTM
[illegible]	26.— S	24 —	May 21, 09	—.—	32 14.—	W	—.—	45 24.—	—.—	24845	70	1.02	BEM
[illegible]	26.— S	24 —	Aug. 28, 09	10.— —.—	32 —.—	W	—.—	45 24.—	—.—	24845	71	1.02/46	JTM
Mafeking [illegible]	25.— S	25 —	May 1, 09	10.— —.—	32 16.1	W	—.—	45 24.—	—.—	24845	70	—.—/—	BEM
Mafeking [illegible]	25.— S	25 —	May 1, 09	10.— —.—	32 15.—	W	—.—	45 24.—	—.—	24845	70	1.02	BEM
Aganum	24.— S	24 —	Aug. 21, 09	—.—	32 17.—	W	—.—	45 23.—	—.—	24845	71	1.02	JTM
[illegible]	25.— S	25 —	May 4, 09	10.— —.—	32 —.—	W	—.—	45 24.—	—.—	24845	71	1.02	JTM
			May 3, 09	10.— 10.— —.—	32 —.—	W	—.—	45 24.—	—.—	24845	70	—.—/—	BEM
			May 3, 09	11.1 10.— 10.—	32 10.—	W					70		BEM
Otter	24.— S	24 —	Aug. 24, 09	—.— —.—	32 10.—	W			—.—	24845	71		JTM
			Aug. 22, 09				11.—	45 15.—	—.—	24845	71	1.02/46	JTM
Kraai	24.— S	24 —	Aug. 25, 09	10.— —.—	32 —.—	W	11.—	45 24.—	—.—	24826	71	1.02/46	JTM
Ramoutsa	24.— S	24 —	Aug. 27, 09	—.— —.—	32 —.—	W	11.—	45 24.—	—.—	24847	71	1.02/46	JTM
Lobatsi	25.— S	25 —	Aug. 28, 09	—.— —.—	32 —.—	W	11.—	45 24.—	—.—	24845	71	1.02/46	JTM
Gaberones	24.— S	25 —	Aug. 29, 09	10.—	32 —.—	W			—.—	24845	71		JTM
			Sept. 1, 09				11.—	45 22.—				1.02/46	JTM
[illegible]	24.— S	25 —	Sept. 4, 09						—.—	24845	71		JTM
Molopo	25.— S	25 —	Sept. 4, 09	10.— —.—	32 11.—	W	11.—	45 24.—	—.—	24845	71	1.02/46	JTM
Pretoria	25.— S	28 —	Sept. 9, 09	10.—	32 14.—	W	11.—	45 24.—	—.—	24845	71	1.02	JTM
			Sept. 10, 09	10.—	32 14.—	W					71		JTM
Hartebeestfontein, Transvaal	25.— S	25 —	Sept. 7, 09	10.— —.—	32 —.—	W	11.—	45 24.—	10.—	24845	71	1.02/46	JTM
Klipfontein	25.— S	26 —	Sept. 14, 09	10.— —.— —.—	32 14.—	W	11.—	45 24.—	—.—	24845	71	1.02	JTM
			Sept. 17, 09	10.— 10.— —.—	32 15.—	W					71		JTM
Port Tennant	25.— S	25 —	Sept. 4, 09						10.—	24831	71		JTM
Lydenburg	25.— S	26 —	Sept. 22, 09				11.—	45 14.—				1.02	JTM
			Sept. 24, 09	9.— —.—	32 10.—	W			—.—	24804	71		JTM
Carolina, Transvaal	25.— S	30 —	Sept. 1, 09	9.— —.—	32 —.—	W	—.—	45 —.—	10.—	24845	71	1.02/46	JTM
Barberton	25.— S	31 —	Sept. 29, 09	10.—	32 —.—	W	11.—	45 24.—			71	1.02	JTM
			May 4, 09	10.—	32 —.—	W			10.—	24831	70		JTM
Victoria Falls	17.— S	25 —	Sept. 30, 09				11.—	45 11.—				—.—/—	BEM
			Sept. 30, 09	9.— —.— —.—	31 —.—	W			—.—	24877	71		BEM
Victoria Falls, Geo Station	17.— S	25 —	Sept. 30, 09				11.—	45 14.—				—.—/—	BEM
			Sept. 27, 09	9.— —.— —.—	31 10.—	W			10.—	24888	70		BEM
			Sept. 28, 09				11.—	45 10.—				—.—/—	BEM
Bulawayo, Tennessee	20.— S	28 —	Sept. —, 09	10.—	31 —.—	W	10.—	44 14.—			71	1.02	JTM
Bulawayo, Beyond	20.— S	28 —	Sept. 10, 09	10.—	31 10.—	W			10.—	24886	71		JTM
Two Temperatures	20.— S	29 —	June 29, 09	—.— —.— —.—	31 —.—	W	—.—	45 —.—	—.— —.—	24882	73	1.02	BEM
Tenerife	20.— S	29 —	June 30, 09	—.— —.— —.—	31 —.—	W	10.—	44 —.—	10.—	24868	73	1.02	BEM
Bulawayo	20.— S	28 —	Sept. 10, 09	9.— 10.— —.—	31 —.—	W			10.—	24868	71		JTM
			Sept. 11, 09	9.— 10.— —.—	31 10.—	W			10.—	24916	71		JTM
			Sept. 12, 09				11.—	45 10.—				1.02/46	JTM
Wankie	18.— S	26 —	June 2, 09	—.— —.— —.—	31 —.—	W	10.—	44 —.—			73	1.02	BEM
			June 3, 09	9.— —.— —.—	31 —.—	W			10.—	24826	73		JTM
Palmer Creek	19.— S	28 —	June 10, 09	9.— —.— —.—	31 —.—	W	10.—	44 45.—	10.—	24822	73	1.02	BEM
Victoria	19.— S	30 —	June 11, 09	—.— —.—	31 —.—	W	9.—	44 45.—	9.—	24844	73	1.02	BEM

AFRICA

BRITISH SOUTH AND CENTRAL AFRICA—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination				Inclination			Horizontal Intensity			Instruments		Observer
				Local Mean Time			Value	L. M. T.		Value	L. M. T.		Value	Magnet	Dip Circle	
	° ′	° ′		h	h	h	° ′	h	h	° ′	h	h				
Dabenoris	28 58.4 S	18 39	Jan. 11, 09	9.2	9.5	13.2	26 08.8 W	6.9	..	57 38.1 S	11.6	..	.12590	72	142.02	JCB
Hemimesiantein	28 57.0 S	18 06	Jan. 14, 05	9.9	..	....	26 21.0 W	10.1	....	57 28.2 S	10.2	....	.13685	73	142.02	JCB
Gingilidoru	29 01.7 S	51 35	Jul. 6, 08	16.0	16.0	....	21 57.3 W	17.2	....	61 22.6 S	16.4	var.	.17125	73	142.0	JCB
			Jul. 7, 08	8.5	9.5	9.6	21 54.6 W	7.5	....	61 30.7 S	8.6	....	.17142	72	142.0	JCB
Wortel	29 02.0 S	18 49	Jan. 10, 09	9.0	12.9	13.4	26 14.3 W	6.8	..	57 45.4 S	11.0	....	.13628	72	142.0203	JCB
Pella	29 02.1 S	19 06	Jan. 8, 09	8.7 to	17.2	P	26 23.4 W	6.6	....	57 55.3 S	12.4	....	.13553	72	142.02	JCB
Modder River	29 03.6 S	24 45	Jan. 26, 08	9.7	9.9	....	21 42.9 W	12.0	....	54 30.9 S	10.6	....	.13077	73	142.0	JCB
Groot Rooyabosch	29 04.5 S	18 54	Jan. 9, 09	9.6	9.5	....	26 52.4 W	11.9	....	57 47.8 S	10.4	....	.13642	72	142.02	JCB
Dennet	29 10.1 S	17 50	Jan. 15, 09	9.7	12.5	....	26 12.0 W	7.2	..	57 26.8 S	11.1	....	.13647	72	142.0202	JCB
Klipfontein	29 12.7 S	17 49	Mar. 15, 09	16.5	..	..	25 58.6 W	13.5	..	57 37.6 S	....	....	....	71	142.02	JTM
			Mar. 19, 09	9.3	14.5	15.2	26 00.5 W	16.5	..	57 44.3 S	10.7	....	.13690	71	142.02	JTM
			Mar. 20, 09	10.4	....	....	26 05.4 W	....	....	....	9.7	....	.13585	71	....	JTM
Aggamys	29 12.9 S	18 49	Jan. 6, 09	9.2	10.5	....	26 16.5 W	....	....	....	11.5	13.1	.13227	72	....	JCB
			Jan. 7, 09	8.2	9.8	9.8	26 16.2 W	6.6	..	58 17.2 S	....	....	....	72	142.0202	JCB
Aus	29 12.9 S	17 48	Jan. 21, 05	8.8	9.4	11.7	26 31.5 W	6.9	..	57 36.2 S	9.8	....	.13577	72	142.02	JCB
Ongrabies	29 15.5 S	18 32	Jan. 5, 09	14.2	14.4	....	26 18.3 W	11.5	....	57 47.8 S	13.7	....	.13492	72	142.02	JCB
Port Nolloth	29 15.6 S	16 51	Mar. 16, 05	10.5	15.5	....	26 48.0 W	16.5	....	57 12.0 S	11.5	....	.13615	71	142.0	JTM
JTM 26	29 15.8 S	17 11	Mar. 17, 05	10.8	..	....	26 21.2 W	13.8	..	57 25.1 S	11.5	..	.13615	71	142.0	JTM
Sabies	29 17.2 S	17 46	Jan. 20, 09	....	....	....	....	11.8	....	57 38.8 S	....	....	....	72	142.02	JCB
Kweekfontein	29 20.0 S	18 02	Jan. 4, 05	8.4	9.8	11.6	26 16.8 W	6.8	....	57 42.8 S	10.5	..	.13537	73	142.02	JCB
O'okiep	29 35.5 S	17 53	Dec. 30, 08	8.8	9.2	12.6	26 26.6 W	....	....	....	10.5	....	.13774	73	....	JCB
			Dec. 31, 08	....	....	....	....	11.5	..	57 32.8 S	....	....	....	..	142.020	JCB
			Jan. 1, 09	9.2	9.6	16.5	26 24.4 W	..	..	..	12.8	....	.13725	73	....	JCB
			Mar. 21, 09	11.0	15.5	....	26 10.5 W	....	....	....	11.7	14.2	.13571	71	....	JTM
Orange River	29 38.0 S	24 16	Jan. 24, 05	10.8 to	13.6	P	24 58.4 W	12.5	....	58 41.0 S	11.7	13.8	.13704	73	142.0	JCB
			Jan. 25, 05	8.0 to	11.6	P	24 52.0 W	....	....	....	10.7	var.	.13602	73	....	JCB
Riesfontein	29 52.1 S	18 11	Dec. 26, 08	9.8 to	13.4	P	26 41.2 W	7.4	..	58 24.8 S	13.1	..	.13536	73	142.0	JCB
			Dec. 27, 08	....	....	....	....	7.8	..	58 28.8 S	....	....	....	..	142.0202	JCB
JCB 33	29 59.4 S	18 39	Dec. 23, 08	9.8 to	11.6	P	26 08.5 W	..	..	..	....	....	....	73	....	JCB
Kamaties	30 02.5 S	18 29	Dec. 24, 08	8.8 to	15.9	D	25 54.4 W	6.6	....	58 44.8 S	10.3	14.1	.13[illegible]	73	142.02	JCB
Hove River	30 06.2 S	30 51	Jul. 4, 08	16.2	16.5	16.8	22 42.8 W	14.5	..	61 41.7 S	....	....	....	73	142.0	JCB
			Jul. 5, 08	8.1 to	11.0	D	22 44.5 W	....	....	....	8.5	....	.17120	73	....	JCB
JCB 30	30 15.7 S	18 26	Dec. 22, 08	7.8 to	16.2	P	26 42.5 W	6.6	....	58 15.5 S	11.5	13.1	.13559	73	142.02	JCB
Aleppyfontein	30 26.6 S	18 56	Dec. 22, 08	8.2	15.8	....	26 25.6 W	14.2	....	58 45.4 S	10.2	13.8	.13[illegible]	73	142.02	JCB
Downes	30 30.4 S	19 57	Jan. 29, 07	10.5	12.8	....	27 12.0 W	10.8	....	58 00.2 S	12.7	....	.13[illegible]	73	142.0	JCB
Nieuwehoven	30 36.0 S	18 41	Dec. 21, 08	13.4	13.6	14.2	26 25.9 W	8.3	....	58 08.3 S	11.4	....	.13567	73	142.02	JCB
JCB 27	30 36.2 S	18 51	Dec. 20, 08	8.6	....	....	26 37.4 W	....	....	....	12.2	....	.13544	73	....	JCB
JCB 26	30 44.3 S	19 12	Dec. 17, 08	7.7 to	16.0	P	26 25.8 W	12.8	....	58 41.8 S	11.2	....	.13576	73	142.02	JCB
Plankilp	30 47.5 S	19 06	Dec. 16, 08	8.6	8.8	....	26 45.5 W	12.2	..	58 30.5 S	11.2	....	.13551	73	142.0	JCB
Graafwater	30 56.4 S	18 16	Dec. 25, 08	8.7	13.5	....	26 42.0 W	12.3	....	58 47.8 S	11.4	....	.13574	73	142.02	JCB
Loerfontein	30 56.9 S	18 26	Dec. 14, 08	8.2 to	16.0	D	26 43.1 W	6.4	....	58 51.1 S	7.8	....	.13[illegible]	73	142.0	JCB
Koppesiraal	31 04.4 S	19 25	Dec. 12, 08	8.5 to	16.5	P	26 44.7 W	13.8	....	58 48.8 S	11.3	....	.13[illegible]	73	142.0	JCB
Nieuwpoort	31 14.6 S	24 53	Jan. 25, 05	9.5	11.8	11.9	25 14.2 W	14.4	....	60 30.8 S	11.5	13.5	.13[illegible]	70	142.02	JTM
Brak River	31 15.6 S	18 30	Dec. 11, 08	8.5	8.8	....	26 47.1 W	11.8	....	58 55.6 S	10.0	....	.13[illegible]	73	142.0	JCB
Willem's River	31 20.1 S	19 06	Jan. 13, 07	15.6	....	....	27 20.4 W	14.5	....	58 51.3 S	11.0	....	.13[illegible]	73	142.0	JCB
Holdervlei	31 22.8 S	19 32	Jan. 27, 07	8.3	8.5	11.2	27 14.1 W	7.7	....	58 06.3 S	10.4	....	.13[illegible]	73	142.0	JCB
			Dec. 30, 08	11.5	13.5	....	26 54.3 W	12.0	....	58 23.7 S	14.1	....	.13[illegible]	73	142.0	JCB
Leeuwvlei	31 25.5 S	19 20	Jan. 24, 07	15.5	....	....	27 18.0 W	13.4	....	58 30.2 S	10.5	....	.13[illegible]	73	142.0	JCB
Brunnerton	31 28.8 S	23 13	Jan. 25, 05	10.5	11.2	12.3	24 47.1 W	12.1	....	60 [illegible] S	10.7	14.1	.13721	71	142.02	JTM
			Jan. 29, 05	13.1	....	....	24 52.0 W	....	....	....	....	....	....	71	....	JTM
			Jan. 23, 05	14.7	....	....	24 57.5 W	....	....	....	....	....	....	70	....	JTM
Van Rhynsdorp	31 29.7 S	18 44.4	Jan. 21, 07	10.8	10.1	11.8	27 38.1 W	....	....	....	10.2	....	.13[illegible]	73	....	JCB
			Jan. 22, 07	....	....	....	....	10.1	....	58 [illegible] S	....	....	....	....	142.0	JCB
Riviet Plants	31 30.1 S	18 42	Jan. 25, 07	14.1	15.2	....	27 12.2 W	11.8	....	58 [illegible] S	11.1	....	.13[illegible]	73	142.0	JCB
Oorlogskloof	31 30.8 S	18 27	Jan. 31, 07	8.5	11.4	....	27 21.0 W	7.4	....	58 [illegible] S	10.7	....	.13[illegible]	73	142.0	JCB
Kamieboch	31 34.5 S	18 54	Jan. 26, 07	11.2	12.1	13.4	27 07.4 W	11.2	....	58 [illegible] S	13.0	....	.13[illegible]	73	142.0	JCB
Karmee	31 44.0 S	18 28	Feb. 1, 07	8.4	10.2	11.4	27 24.8 W	7.2	....	58 [illegible] S	10.1	....	.13[illegible]	73	142.0	JCB
Windhoek	31 44.4 S	18 36	Jan. 24, 07	11.4	12.2	13.0	27 [illegible] W	11.3	....	58 [illegible] S	13.4	....	.13[illegible]	73	142.0	JCB
Draaihoek	31 45.3 S	18 42	Dec. 9, 08	7.7	8.2	12.7	27 [illegible] W	12.2	....	58 [illegible] S	10.2	13.8	.13[illegible]	73	142.0	JCB
Doorn River	31 52.1 S	18 41	Jan. 23, 07	9.5	12.5	13.7	27 [illegible] W	10.5	....	58 [illegible] S	12.8	....	.13[illegible]	73	142.0	JCB
Schuurkraal	31 57.0 S	18 49	Dec. 7, 08	12.5	....	....	27 [illegible] W	11.3	....	58 [illegible] S	13.4	....	.13[illegible]	73	142.0	JCB
Rusbank	31 58.7 S	18 47	Jan. 19, 07	15.7	....	....	27 [illegible] W	13.2	....	58 [illegible] S	14.8	....	.13[illegible]	73	142.0	JCB
Craigieck	32 [illegible] S	25 36	Jan. 24, 05	11.4	12.1	13.7	25 [illegible] W	14.8	....	60 [illegible] S	12.1	13.8	.13[illegible]	71	....	JTM
Augsburg	32 [illegible] S	25 53	Jan. [illegible], 07	14.2	15.2	15.2	27 [illegible] W	13.4	....	58 [illegible] S	14.5	....	.13[illegible]	73	142.0	JCB
Stompneusvlei	32 15.5 S	19 45	Dec. 4, 08	8.4	12.1	....	27 [illegible] W	13.8	....	58 [illegible] S	11.8	....	.13[illegible]	73	142.02	JCB
Papekuil	32 27.8 S	18 46	Dec. 3, 08	11.2	11.4	....	27 17.1 W	....	....	....	11.2	12.7	.13[illegible]	73	....	JCB
De Kruis	32 38.7 S	25 44	Jan. [illegible], 07	11.7	12.4	13.2	25 [illegible] W	16.3	....	58 [illegible] S	14.2	....	.13[illegible]	73	142.0	JCB

AFRICA.

BRITISH SOUTH AND CENTRAL AFRICA—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Modderfontein	32 36.8 S	18 59	Jan 12,'07	11.0, 14.4, 16.3	27 42.3 W	7.1	59 10.2 S	11.2, 15.4	.18103	73	142.3	JCB
Eendekuil	32 41.2 S	18 52	Jan 8, 07	16.5, 16.7	27 39.1 W	.....	.....	11.0, 18.3	.18141	73	.....	JCB
			Jan 9, 07	9.7, 12.0, 15.2	27 42.6 W	11.3	59 14.5 S	.....	.....	73	142.3	JCB
Gansfontein	32 43.6 S	19 42	Dec 2, 08	10.3, 10.6	27 50.8 W	12.6	59 47.6 S	11.1	.17885	73	142.3	JCB
Beukesfontein	32 55.1 S	19 43	Dec 1, 08	9.8, 10.4, 13.6	27 50.8 W	15.9	59 59.5 S	12.2	.17817	73	142.123	JCB
Zoutpansdrift	33 09.9 S	19 43	Nov 30, 08	9.4, 12.2	27 42.3 W	14.6	60 07.3 S	10.8	.17733	73	142.3	JCB
Matjesfontein	33 14.2 S	20 36	Jun 20, 08	15.2, 15.5	27 46.8 W	10.9	60 28.2 S	13.8	.17633	73	142.3	JCB
			Jun 21, 08	10.8 to 16.8(10)	27 42.7 W	.....	.....	14.7, 16.4	.17618	73	.....	JCB
			Jun 21, 08	11.1, 11.7, 12.3	27 44.8 W	.....	.....	.....	.....	31	.....	JTM
			Jun 22, 08	.....	.....	10.3, 14.3	60 30.2 S	9.5, 11.3	.17621	73	142.3	JCB
			Jun 22, 08	.....	.....	14.4	60 31.8 S	.....	.....	..	9.12	JTM
Leeuwenfontein	33 17.4 S	19 30	Nov 28, 08	9.9, 10.2, 13.8	27 52.2 W	7.3	59 53.8 S	11.0, 13.2	.17810	73	142.3	JCB
Ceres	33 22.5 S	19 15	Nov 27, 08	13.3, 13.6	27 28.0 W	10.8	59 53.5 S	12.7	.17810	73	142.3	JCB
Ceres Road	33 25.6 S	19 19	Oct 4, 08	10.6, 11.6, 16.8	27 37.0 W	14.7	59 55 S	.....	.....	73	142.(34)	JCB
			Oct 4, 08	10.7, 11.4, 17.0	27 37.5 W	15.2	59 56.4 S	.....	.....	31	9.12	JTM
			Oct 5, 08	10.7	27 39.9 W	.....	.....	8.3, 9.9	.17872	73	.....	JCB
			Oct 5, 08	11.8	27 39.8 W	.....	.....	7.6, 11.2	.17874	31	.....	JTM
Cape Town (JCB)	33 56.1 S	18 29	Oct 24, 08	15.3	27 54.4 W	.....	.....	.....	.....	73	.....	JTM
			Oct 25, 08	9.8 to 14.7(15)	28 01.3 W	.....	.....	.....	.....	73	.....	JCB
			Nov 1, 08	.....	.....	9.6, 11.7	59 47.0 S	.....	.....	..	142.123	JCB
			Nov 1, 08	.....	.....	14.2	59 49.0 S	.....	.....	..	142.123	JCB
			Nov 8, 08	.....	.....	.....	.....	10.7, 14.2	.17770	73	.....	JCB
			Nov 8, 08	.....	.....	.....	.....	15.5	.17718	73	.....	JCB
			Nov 9, 08	.....	.....	.....	.....	9.7, 11.0	.17798	73	.....	JCB
Cape Town (JTM)	33 56.1 S	18 29	Oct 24, 08	15.9	27 58.4 W	.....	.....	.....	.....	31	.....	JTM
			Oct 25, 08	9.6 to 15.0(8)	28 01.3 W	.....	.....	.....	.....	31	.....	JTM
			Oct 31, 08	.....	.....	15.4, 16.4	59 50.2 S	.....	.....	..	9.1234	JTM
			Nov 1, 08	.....	.....	9.7, 11.8	59 46.8 S	.....	.....	..	9.1234	JTM
			Nov 1, 08	.....	.....	14.2	59 48.9 S	.....	.....	..	9.1234	JTM
			Nov 8, 08	.....	.....	.....	.....	10.7, 14.3	.17774	31	.....	JTM
			Nov 8, 08	.....	.....	.....	.....	15.6	.17721	31	.....	JTM
			Nov 9, 08	.....	.....	.....	.....	9.8, 11.0	.17790	31	.....	JTM
			Nov 9, 08	.....	.....	.....	.....	13.5	.17789	31	.....	JTM

EGYPT.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Port Said	31 16.4 N	32 18	May 1,'08	15.0, 16.8	2 31.7 W	.....	.....	15.5, 16.5	.29631	5	.....	JCP
			May 2, 08	.....	.....	10.9	42 34.4 N	.....	.....	..	177.1256	JCP
Port Said, N	31 16.4 N	32 18	May 2, 08	16.1	2 30.8 W	15.0	42 35.2 N	16.5	.29612	5	177.12	JCP
Port Said, E	31 16.4 N	32 18	May 3, 08	9.3	2 28.2 W	11.3	42 33.4 N	9.8	.29593	5	177.12	JCP
Alexandria (Koor)	31 16.3 N	30 00	May 14, 08	9.3, 11.0	3 19.3 W	15.5	42 46.5 N	9.7, 10.6	.29448	5	177.1256	JCP
Alexandria (Koor), Secondary	31 16.3 N	30 00	May 15, 08	9.8	3 18.3 W	8.9	42 47.2 N	10.2	.29465	5	177.12	JCP
Suez	29 58.1 N	32 33	May 6, 08	10.1, 12.1	2 44.0 W	15.1	40 35.5 N	10.6, 11.7	.30246	5	177.1256	JCP
Helwan Observatory, North Pier, Absolute House	29 51.6 N	31 20	Apr 26, 08	15.1, 15.3, 17.4	2 57.2 W	.....	.....	16.4 ...	.30040	5	.....	JCP
			Apr 27, 08	8.8, 11.5	2 55.8 W	.....	.....	10.1	.30059	5	.....	JCP
			Dec 17, 09	15.5, 15.9	2 44.6 W	11.6	40 40.3 N	.....	.....	73	142.1235	JCB
			Dec 18, 09	.....	.....	.....	.....	12.0	.30047	73	.....	JCB
Helwan Observatory, North Pier, Porch	29 51.6 N	31 20	Apr 21, 08	.....	.....	16.6	40 37.8 N	.....	.....	..	177.12	JCP
			Apr 22, 08	12.4, 12.7	3 01.2 W	.....	.....	16.2	.30049	5	.....	JCP
			Apr 23, 08	8.9, 11.0	2 56.2 W	12.5, 16.3	40 38.4 N	10.0	.30045	5	177.12	JCP
			Apr 24, 08	15.6, 17.3	2 58.2 W	9.5, 11.8	40 38.7 N	16.4	.30044	5	177.56	JCP
			Apr 25, 08	8.6, 10.5	2 54.2 W	12.1, 16.0	40 38.8 N	9.8	.30046	5	177.1256	JCP
			Dec 17, 09	16.5, 16.8	2 45.2 W	13.1	40 40.4 N	.....	.....	73	142.1235	JCB
			Dec 18, 09	.....	.....	.....	.....	10.2	.30036	73	.....	JCB
Helwan Observatory, South Pier, Porch	29 51.6 N	31 20	Apr 26, 08	.....	.....	9.4, 11.2	40 37.9 N	.....	.....	..	177.56	JCP

AFRICA.

GERMAN EAST AFRICA.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Mtukula	1 00.3 S	31 25	Sep 30,'09	10.6, 16.7	7 09.4 W	15.1	25 06.7 S	9.5	.31075	73	142.1235	JCB
			Oct 1, 09	.....	.....	11.0	25 04.0 S	.....	.....	..	142.1235	JCB
Kayamwasha	1 07.6 S	31 24	Sep 29, 09	9.8	7 14.8 W	11.1	26 03.0 S	9.0	.30901	73	142.1235	JCB
Ngorora	1 13.3 S	31 34	Sep 27, 09	9.5	7 19.3 W	11.2	26 06.7 S	8.8	.30714	73	142.1235	JCB
Chaiomo	1 13.5 S	31 37	Sep 26, 09	9.8	7 15.4 W	.....	.....	8.8	.30565	73	.....	JCB
Gera	1 13.9 S	31 45	Sep 25, 09	10.0	7 11.0 W	11.2	26 07.2 S	9.0	.30814	73	142.1235	JCB
Kifumbiro	1 15.5 S	31 26	Sep 28, 09	9.1, 10.2	7 19.5 W	11.2	26 16.5 S	8.5	.30641	73	142.1235	JCB
Bukoba	1 20 S	31 52	Sep 19, 09	16.5	7 09.1 W	14.5	26 08.5 S	16.9(wt.½)	.30876	73	142.1235	JCB
			Sep 20, 09	16.6	7 09.5 W	.....	.....	14.6	.30899	73	.....	JCB
Kanazi	1 31 S	31 48	Sep 18, 09	12.2	7 00.7 W	7.6	26 32.1 S	12.5	.30664	73	142.1235	JCB
Katoki	1 44.7 S	31 46	Sep 17, 09	13.5	7 32.5 W	7.5	26 58.6 S	10.0	.30639	73	142.1235	JCB
Mrewa	1 50.3 S	31 42	Sep 16, 09	9.6, 11.4	7 27.6 W	6.9, 7.6	27 26.0 S	10.6	.30508	73	142.12	JCB
Nyrwura	2 02.0 S	31 38	Sep 14, 09	16.4	7 27.8 W	13.0, 13.6	27 46.6 S	14.9	.30431	73	142.12	JCB
Rusampia	2 07.6 S	31 32	Sep 13, 09	15.2	7 28.1 W	12.9	27 58.7 S	14.1	.30442	73	142.12	JCB
Rwampindi	2 20.2 S	31 27	Sep 11, 09	17.1	7 37.6 W	.....	.....	.....	.....	73	.....	JCB
			Sep 12, 09	9.2	7 39.4 W	10.9	28 27.8 S	8.5	.30184	73	142.1235	JCB
Misuruti	2 26.5 S	31 25	Sep 10, 09	16.1	7 51.3 W	.....	.....	.....	.....	73	.....	JCB
			Sep 11, 09	7.9, 9.9	7 41.4 W	11.6	28 36.8 S	9.3	.30114	73	142.12	JCB
Usuvi	2 37.9 S	31 18	Sep 9, 09	9.2, 12.4	7 43.0 W	13.4	28 57.8 S	10.6	.29821	73	142.12	JCB
Mwite Camp	2 44.9 S	31 27	Sep 5, 09	8.9	7 37.0 W	10.0	29 08.1 S	9.4	.29971	73	142.1	JCB
Kasusiwakaie	2 49 S	31 43	Sep 2, 09	16.8	7 45.5 W	.....	.....	.....	.....	73	.....	JCB
			Sep 3, 09	.....	.....	9.6	29 28.0 S	7.7	.30196	73	142.1235	JCB
Musasa	2 50 S	31 47	Sep 2, 09	10.0	7 43.5 W	11.0	29 25.1 S	8.1	.29958	73	142.12	JCB
Nakasikwi	2 59.1 S	31 57	Aug 31, 09	9.4, 11.6	7 59.0 W	7.4	29 41.1 S	10.7	.30075	73	142.1235	JCB
Niseni	3 00.4 S	31 50	Sep 1, 09	10.3	8 23.3 W	11.1	29 21.9 S	7.4	.30363	73	142.12	JCB
Uyombe	3 04.8 S	32 04	Aug 29, 09	.....	.....	.....	.....	13.6	.30013	73	.....	JCB
			Aug 30, 09	7.4, 8.4, 8.6	7 50.7 W	10.8	29 54.3 S	.....	.....	73	142.1235	JCB
Luhembe's Village	3 09.5 S	32 12	Aug 28, 09	16.8	7 47.2 W	14.0	30 04.6 S	15.1	.29917	73	142.12	JCB
JCB 177	3 19.3 S	32 18	Aug 27, 09	.....	.....	13.6	30 23.2 S	15.4	.29821	73	142.12	JCB
Kajumbo's Village	3 26.4 S	32 24	Aug 26, 09	16.4	7 48.6 W	14.3	31 38.4 S	15.0	.29749	73	142.12	JCB
Machivia's Village	3 35.6 S	32 29	Aug 25, 09	16.5	7 39.5 W	14.0	31 39.4 S	15.2	.29173	73	142.12	JCB
Luvumbo's Village	3 45 S	32 30	Aug 24, 09	16.0	8 07.6 W	13.4	31 28.9 S	15.0	.29603	73	142.1235	JCB
Swira's Village	3 53.8 S	32 31	Aug 23, 09	.....	.....	13.7	31 34.6 S	15.2	.29471	73	142.1235	JCB
Ukamba	4 03.2 S	32 36	Aug 22, 09	7.8, 10.4, 15.0	8 00.1 W	13.6	31 53.1 S	10.3	.29567	73	142.1235	JCB
Chona	4 06.7 S	32 38	Aug 21, 09	13.6	8 02.9 W	12.6	31 53.4 S	13.2	.29471	73	142.12	JCB
Mabuku	4 22.6 S	32 42	Aug 20, 09	14.4	8 06.4 W	13.2	32 28.0 S	13.9	.29301	73	142.12	JCB
Tumbagi	4 36.7 S	32 43	Aug 19, 09	16.6	8 31.0 W	13.2	33 03.3 S	14.8	.29241	73	142.1235	JCB
Igombe	4 47.5 S	32 52	Aug 18, 09	16.6	8 08.8 W	13.4	33 17.5 S	14.9	.29110	73	142.1235	JCB
Tabora	5 01.2 S	32 49	Aug 15, 09	9.4, 16.6	8 23.8 W	14.3	33 42.9 S	12.4	.28950	73	142.1235	JCB
Urumwa	5 10.5 S	32 45	Aug 13, 09	16.1, 16.3	8 18.4 W	12.1	33 48.2 S	13.9	.28915	73	142.1235	JCB
Mpangalle	5 17.5 S	32 42	Aug 12, 09	10.3, 13.1, 16.1	8 17.7 W	14.8	34 05.2 S	11.8	.28904	73	142.1235	JCB
Totua	5 30.0 S	32 41	Aug 10, 09	15.8	7 40.4 W	.....	.....	14.9	.28550	73	.....	JCB
			Aug 11, 09	9.4, 10.5, 11.0	7 42.9 W	7.8	34 22.6 S	.....	.....	73	142.1235	JCB
Kirongozi	5 41.3 S	32 34	Aug 9, 09	15.3, 15.4, 16.4	8 56.8 W	13.0	34 39.8 S	14.3	.28636	73	142.12	JCB
Kakomé	5 47.5 S	32 24	Aug 8, 09	16.2	8 33.9 W	13.2	34 53.4 S	14.7	.28587	73	142.12	JCB
Kisinde	5 56.0 S	32 19	Aug 7, 09	16.6, 17.1	8 38.2 W	13.8	35 13.0 S	15.0	.28474	73	142.12	JCB
Mwangwa la Mallalé	6 02.4 S	32 08	Aug 6, 09	16.4, 17.2	9 06.8 W	13.9	36 02.6 S	15.1	.28086	73	142.1235	JCB
Luwemba	6 08.4 S	31 59	Aug 5, 09	13.3, 14.9, 15.6	9 07.8 W	11.6	35 38.5 S	14.2	.28326	73	142.1235	JCB
Tekanda	6 14.3 S	31 56	Aug 4, 09	16.5	9 05.4 W	12.9	35 33.9 S	14.4	.28295	73	142.1235	JCB
Kajombo	6 23.3 S	31 52	Aug 3, 09	16.6	9 02.7 W	14.3	36 01.0 S	11.8, 13.0	.28260	73	142.1235	JCB
Kapoli	6 28.4 S	31 47	Aug 2, 09	16.8, 17.2	8 45.7 W	13.3	36 02.4 S	14.8	.28013	73	142.1235	JCB
Ugolole	6 38.1 S	31 46	Aug 1, 09	16.0, 16.6, 16.7	8 26.5 W	12.8	36 20.2 S	14.4	.28460	73	142.1235	JCB
Mwinyisagara	6 45.0 S	36 50	Oct 6, 09	15.4, 17.6	7 17.4 W	.....	.....	16.8	.28296	31	.....	JTM
			Oct 7, 09	.....	.....	10.4	37 16.9 S	.....	.....	..	9.12(46)	JTM
Ngere Ngere	6 45.8 S	38 06	Oct 2, 09	10.3	7 04.8 W	11.7	37 10.3 S	10.6(wt.½)	.28464	31	9.12	JTM
			Oct 9, 09	13.8	7 01.8 W	17.1	37 18.2 S	14.8	.28413	31	9.(46)	JTM
			Oct 10, 09	.....	.....	16.3	37 14.8 S	.....	.....	..	9.12(46)	JTM
Mkatta	6 46 S	37 17	Oct 8, 09	.....	.....	13.4	37 17.2 S	11.0	.28352	31	9.12(46)	JTM
Kalovia	6 46.6 S	31 45	Jul 30, 09	.....	.....	.....	.....	14.4, 15.7	.27640	73	.....	JCB
			Jul 31, 09	8.4, 11.2, 16.0	8 56.1 W	12.8	37 01.0 S	.....	.....	73	142.1235	JCB
Dar-es-Salaam	6 48.8 S	39 18	Sep 28, 09	15.7, 17.8	6 33.5 W	.....	.....	16.8	.28396	31	.....	JTM
			Sep 29, 09	10.0	6 40.1 W	11.4	37 17.7 S	.....	.....	31	9.12(46)	JTM
			Sep 30, 09	14.9	6 32.7 W	15.8	37 24.0 S	.....	.....	31	9.12	JTM
JTM 138	6 48.9 S	38 20	Oct 11, 09	15.1, 17.3	6 51.5 W	.....	.....	16.5	.28387	31	.....	JTM
			Oct 12, 09	.....	.....	8.8	37 19.8 S	.....	.....	..	9.12(46)	JTM
Ruvu	6 48.9 S	38 39	Oct 12, 09	15.7	6 49.3 W	.....	.....	17.2	.28408	31	.....	JTM
			Oct 13, 09	.....	.....	10.0	37 15.7 S	.....	.....	..	9.12(46)	JTM

AFRICA.

GERMAN EAST AFRICA—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Morogoro	6 49.8 S	37 43	Oct 4,'09	10.9, 14.2	6 24.4 W	15.8	37 34.6 S	12.4	.28206	31	9.12(46)	JTM
Kilossa	6 50.0 S	36 55	Oct 5, 09	13.5, 15.0	7 25.4 W	17.3	37 12.5 S	14.2	.28299	31	9.12(46)	JTM
Soga	6 50.0 S	38 51	Oct 14, 09	8.7, 10.3	6 46.7 W	11.6	37 20.9 S	9.5	.28462	31	9.12(46)	JTM
Kimoto	6 53.3 S	31 38	Jul 29, 09	16.5	9 54.6 W	13.4	37 45.9 S	14.9	.27586	73	142.1235	JCB
Punga River	6 57.3 S	31 32	Jul 28, 09	16.4	9 21.0 W	13.7	36 54.5 S	15.2	.27813	73	142.1235	JCB
Igwa Manoni	7 06.6 S	31 28	Jul 27, 09	16.4, 16.6	9 42.7 W	13.3	37 25.4 S	14.9	.27645	73	142.1235	JCB
Mpimbwe	7 14.9 S	31 23	Jul 26, 09	15.2	9 30.5 W	13.7	37 59.8 S	14.4	.27434	73	142.12	JCB
Kakolé	7 20.2 S	31 25	Jul 25, 09	16.1, 16.9	9 32.2 W	12.8	37 34.1 S	14.4	.27556	73	142.1235	JCB
Polumko	7 27.2 S	31 22	Jul 24, 09	16.7	9 23.8 W	13.3	37 50.0 S	15.1	.27521	73	142.1235	JCB
Sopa	7 31.9 S	31 20	Jul 22, 09	16.5	9 34.6 W	.....	.....	.....	.....	73	.....	JCB
			Jul 23, 09	10.5, 12.7, 14.9	9 34.8 W	8.0	37 55.9 S	11.5	.27566	73	142.1235	JCB
Mayembe	7 42.0 S	31 18	Jul 21, 09	16.5, 17.0	9 37.2 W	15.3	38 14.8 S	13.9	.27437	73	142.1235	JCB
Katé	7 51.9 S	31 12	Jul 20, 09	15.7, 16.5	9 41.0 W	14.9	38 37.2 S	13.5	.27253	73	142.1235	JCB
Kapalula	8 02.9 S	31 16	Jul 19, 09	15.0, 16.0	10 25.2 W	14.3	38 57.7 S	12.4	.26982	73	142.1235	JCB
Msaramba River	8 10.7 S	31 16	Jul 18, 09	15.7, 16.4	10 05.8 W	13.1	39 10.4 S	14.9	.27075	73	142.1235	JCB
Njanda	8 20.7 S	31 15	Jul 17, 09	14.0, 15.6	10 15.4 W	12.3	39 27.8 S	14.8	.27012	73	142.1235	JCB
Bismarckburg	8 27.3 S	31 08	Jul 12, 09	15.2, 16.2	10 42.8 W	10.7	39 58.0 S	.....	.....	73	142.1235	JCB
			Jul 13, 09	9.8, 10.7	10 44.3 W	.....	.....	11.0(wt.½)	.26750	73	.....	JCB
			Jul 15, 09	.....	.....	.....	.....	16.2	.26702	73	.....	JCB
Kalambo River	8 35.6 S	31 15	Jul 10, 09	16.6, 16.8	10 15.9 W	13.4	39 37.4 S	14.9	.26872	73	142.1235	JCB

GERMAN SOUTHWEST AFRICA.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Tsumeb	19 13.3 S	17 50	Feb 12,'09	10.9	21 03.4 W	19.0	50 20.6 S	12.0	.21504	31	9.123	JTM
Korab	19 27.6 S	17 33	Feb 13, 09	11.9, 13.8	21 08.1 W	18.0	50 32.5 S	15.9	.21325	31	9.123	JTM
Otavi	19 38.2 S	17 30	Feb 14, 09	15.6, 18.1	21 12.2 W	.....	.....	17.2	.21253	31	.....	JTM
			Feb 15, 09	.....	.....	8.2	50 46.2 S	.....	.....	..	9.123	JTM
Okaputa	20 05 S	17 07	Feb 15, 09	18.2	21 36.0 W	.....	.....	.....	.....	31	.....	JTM
			Feb 16, 09	10.3	21 36.4 W	8.5	51 11.1 S	11.3	.21057	31	9.123	JTM
Otjiwarongo	20 27.1 S	16 45	Feb 17, 09	9.8, 11.9	21 47.2 W	17.7	51 28.2 S	10.8	.20732	31	9.123	JTM
Kalkfeld	20 53.5 S	16 13	Feb 18, 09	11.4, 13.8	22 03.0 W	17.4	51 24.3 S	12.7	.20977	31	9.123	JTM
			Feb 19, 09	.....	.....	7.5	51 20.9 S	.....	.....	..	9.12	JTM
Epako	21 13.9 S	16 03	Feb 19, 09	14.5	22 17.3 W	.....	.....	16.8	.20787	31	.....	JTM
			Feb 20, 09	9.6	22 21.0 W	8.5	51 23.3 S	.....	.....	31	9.123	JTM
Omaruru	21 24.7 S	15 59	Feb 20, 09	17.3	22 07.8 W	.....	.....	.....	.....	31	.....	JTM
			Feb 22, 09	11.2, 13.2	22 08.6 W	15.9	51 41.8 S	12.2	.20721	31	9.123	JTM
Erongo	21 42.2 S	15 51	Feb 23, 09	16.9, 17.1	22 49.0 W	.....	.....	.....	.....	31	.....	JTM
			Feb 24, 09	10.5, 10.6	22 50.8 W	8.5	51 45.2 S	11.5	.20639	31	9.123	JTM
Kilometer 275	21 53.0 S	16 35	Feb 26, 09	15.9	22 46.0 W	17.4	52 22.1 S	.....	.....	31	9.123	JTM
			Feb 27, 09	10.4	22 52.0 W	.....	.....	8.9	.20529	31	.....	JTM
Kilometer 233	21 54.6 S	16 05	Feb 25, 09	11.3	22 53.6 W	.....	.....	12.7, 13.3	.20400	31	.....	JTM
Karibib	21 56.3 S	15 53	Feb 9, 09	10.7, 12.6, 15.6	22 50.8 W	16.9	52 13.8 S	11.4	.20546	31	9.123	JTM
Okahandja	21 58.9 S	16 51	Feb 27, 09	.....	.....	17.8	52 29.8 S	.....	.....	..	9.12	JTM
			Feb 28, 09	10.2	22 44.6 W	.....	.....	11.2	.20489	31	.....	JTM
Usakos	22 00.1 S	15 38	Mar 4, 09	14.4, 16.8, 17.1	22 59.9 W	18.5	52 17.3 S	11.4	.20449	31	9.1	JTM
Ebony	22 04.9 S	15 16	Mar 6, 09	11.2, 18.1	23 31.6 W	9.0	51 50.7 S	12.6	.20888	31	9.123	JTM
Kubas	22 16.3 S	15 35	Feb 6, 09	10.7, 12.9	23 06.4 W	.....	.....	11.8	.20468	31	.....	JTM
			Feb 8, 09	.....	.....	10.1	52 12.5 S	.....	.....	..	9.123	JTM
Trekkopje	22 17.3 S	15 07	Mar 7, 09	11.0, 16.8	21 15.4 W	18.1	53 30.9 S	12.1	.19871	31	9.123	JTM
Otjihavera	22 17.9 S	16 57	Mar 1, 09	8.9, 10.2, 12.0	22 50.6 W	.....	.....	11.2, 12.8	.20441	31	.....	JTM
Khan Copper Mine	22 30.0 S	15 00	Feb 2, 09	11.4, 15.6	22 41.4 W	17.5	52 40.4 S	14.5	.20020	31	9.123	JTM
Windhoek	22 33.8 S	17 05	Mar 2, 09	11.8, 11.9	22 54.6 W	14.9	52 58.8 S	16.2	.20350	31	9.123	JTM
Jakalswater	22 36.1 S	15 18	Feb 4, 09	10.4, 16.5	23 24.0 W	17.8	52 27.3 S	11.3	.20354	31	9.123	JTM
Richtofen	22 37.8 S	14 42	Jan 31, 09	11.3, 11.5, 16.8	23 37.8 W	18.4	51 50.4 S	12.8	.20639	31	9.123	JTM
Swakopmund	22 40.7 S	14 32	Jan 28, 09	10.6, 10.9, 11.0	23 36.3 W	16.9	51 58.4 S	12.8	.20558	31	9.1234	JTM
			Jan 29, 09	9.0, 9.2	23 38.0 W	17.5	51 59.0 S	12.8	.20541	31	9.1234	JTM
			Mar 9, 09	9.3, 12.1, 17.2	23 37.2 W	17.0	51 59.4 S	11.0	.20573	31	9.123	JTM
Aris	22 45.8 S	17 10	Mar 27, 09	.....	.....	13.4	53 09.4 S	10.4	.20232	73	142.12	JCB
Nabitsaus	22 58.5 S	17 14	Mar 26, 09	9.0, 11.8	23 13.6 W	13.0	53 21.2 S	10.6	.20160	73	142.12	JCB
Usib Poort	23 06.7 S	17 09	Mar 25, 09	8.5, 9.0, 11.7	23 14.9 W	12.8	53 11.6 S	10.5	.20270	73	142.12	JCB
Rehoboth	23 19.6 S	17 05	Mar 24, 09	9.4, 9.8	23 19.8 W	11.6	53 47.0 S	10.3	.20100	73	142.12	JCB
Awasap	23 31.7 S	17 06	Mar 23, 09	8.9, 9.3, 11.8	23 07.0 W	13.0	54 24.2 S	10.5	.19821	73	142.12	JCB
Tsumis	23 44.0 S	17 10	Mar 22, 09	8.9, 9.4, 12.1	23 47.2 W	13.1	53 58.3 S	10.8	.19882	73	142.12	JCB
Sendlingsgrab	23 57.8 S	17 18	Mar 21, 09	8.7, 9.2, 11.8	23 51.5 W	13.0	54 09.4 S	10.6	.19882	73	142.12	JCB
JCB 84	24 09.2 S	17 22	Mar 20, 09	11.0	23 28.6 W	12.8	54 29.6 S	11.6	.19734	73	142.12	JCB
JCB 83	24 18.4 S	17 30	Mar 19, 09	9.1, 9.8, 10.2	24 00.0 W	11.2	54 38.2 S	10.4	.19734	73	142.12	JCB

AFRICA.

GERMAN SOUTHWEST AFRICA—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Haribes	24 41.5 S	17 34	Mar 17,'09	8.4, 11.4, 11.7	24 01.5 W	12.9	54 38.6 S	10.4	.19671	73	142.12	JCB
Sesskameelboom	24 52.7 S	17 38	Mar 16, 09	8.7, 11.7	24 06.6 W	13.0	54 44.8 S	10.2	.19659	73	142.12	JCB
Gibeon	25 07.2 S	17 42	Mar 14, 09	9.1, 13.2, 14.7	24 09.7 W	.....	.....	11.3	.19577	73	.....	JCB
			Mar 15, 09	9.0	24 12.3 W	8.5	55 02.6 S	.....	.....	73	142.12	JCB
JCB 79	25 13.5 S	17 48	Mar 13, 09	9.0, 11.8	24 19.2 W	13.1	55 07.9 S	10.4	.19538	73	142.12	JCB
Dickdoorn	25 30.0 S	17 58	Mar 11, 09	14.6	24 19.9 W	13.4	55 17.6 S	14.1	.19447	73	142.12	JCB
Kye Charp River	25 42.4 S	18 04	Mar 9, 09	9.0, 9.4, 11.8	24 32.3 W	13.1	55 25.9 S	10.8	.19431	73	142.12	JCB
Korrobib	25 51.5 S	18 10	Mar 8, 09	9.8, 10.0	24 42.8 W	13.5	55 32.4 S	11.7	.19395	73	142.12	JCB
Kumnabis River	25 59.5 S	18 19	Mar 7, 09	9.7, 13.6	24 47.6 W	14.5	55 42.4 S	11.0, 12.9	.19386	73	142.12	JCB
Fahlgras	26 05.6 S	18 30	Mar 5, 09	8.0 to	24 41.6 W	.....	.....	.....	.....	73	.....	JCB
			Mar 6, 09	8.0 (d. v.)		.....	.....	.....	.....	73	.....	JCB
			Mar 6, 09	.....	.....	13.0	55 56.0 S	10.2	.19339	73	142.12	JCB
JCB 73	26 11.6 S	18 29	Mar 4, 09	8.0 to 13.4(6)	24 46.4 W	14.1	56 05.4 S	10.2, 12.0	.19258	73	142.12	JCB
Spitzkop	26 25.5 S	18 23	Mar 3, 09	9.6, 10.1, 11.0	24 53.6 W	11.9	55 54.1 S	11.2	.19300	73	142.12	JCB
Garakanas	26 29.4 S	18 09	Mar 2, 09	10.2, 13.6	24 40.7 W	7.9	55 55.0 S	11.6	.19321	73	142.12	JCB
Tschaukaib	26 34.5 S	15 37	Feb 22, 09	8.3, 9.7, 13.2	25 13.2 W	13.8	55 07.4 S	10.6, 12.3	.19372	73	142.1	JCB
Keetmanshoop	26 34.7 S	18 04	Feb 28, 09	7.5 to 16.6(9)	24 42.9 W	.....	.....	12.0	.19248	73	.....	JCB
			Mar 1, 09	9.4	24 48.8 W	.....	.....	.....	.....	73	.....	JCB
Garub	26 36.4 S	16 56	Feb 21, 09	8.4 to 16.7(8)	25 01.4 W	14.8	54 58.7 S	11.0, 13.0	.19434	73	142.12	JCB
Gobas	26 38 S	18 02	Feb 10, 09	10.0, 14.9	25 01.2 W	7.7	56 08.8 S	11.4, 13.2	.19210	73	142.1235	JCB
Shakals Kuppe	26 38.2 S	16 32	Feb 18, 09	9.3 to 14.8(8)	24 30.0 W	7.5	55 46.2 S	11.4, 14.3	.19350	73	142.1235	JCB
Aus	26 40.3 S	16 12	Feb 19, 09	16.5	25 03.9 W	.....	.....	.....	.....	73	.....	JCB
			Feb 20, 09	9.6, 11.9	25 11.3 W	6.8	55 16.4 S	10.8	.19345	73	142 12	JCB
Kuibis	26 40.7 S	16 48	Feb 17, 09	9.4, 9.7	24 33.2 W	11.6	55 30.6 S	10.1, 10.5	.19384	73	142.12	JCB
Buchholzbrunn	26 41.6 S	17 04	Feb 15, 09	16.7	24 14.0 W	.....	.....	17.4(wt.½)	.19428	73	.....	JCB
			Feb 16, 09	9.3, 10.1, 13.5	24 18.3 W	7.4	55 24.2 S	11.3, 12.9	.19434	73	142.1235	JCB
Rotkuppe	26 42.4 S	15 19	Feb 23, 09	8.2 to 11.4(5)	24 57.2 W	7.2	55 14.3 S	10.0	.19617	73	142.12	JCB
JCB 62	26 47.8 S	17 14	Feb 14, 09	9.7, 10.8, 15.0	24 28.5 W	7.4	55 24.2 S	13.2	.19441	73	142.12	JCB
Seeheim	26 48.5 S	17 44	Feb 9, 09	9.5, 10.0	25 12.0 W	11.0	56 13.0 S	10.4	.19124	73	142.1	JCB
Sandverhaar	26 50.4 S	17 22	Feb 12, 09	16.8, 17.1	25 10.8 W	.....	.....	17.5(wt.½)	.19161	73	.....	JCB
			Feb 13, 09	9.0, 9.5	25 19.4 W	7.3	55 57.2 S	10.5	.19158	73	142.12	JCB
Gawachab	27 01.8 S	17 48	Feb 7, 09	10.0, 10.4	25 54.2 W	7.7	56 36.0 S	11.8	.18985	73	142.12	JCB
Holoog	27 24.0 S	17 44	Feb 6, 09	9.3	25 25.8 W	12.5	56 23.4 S	9.6	.19033	73	142.1	JCB
Gründoorn	27 25.7 S	18 15	Feb 4, 09	9.7, 12.2	25 10.0 W	7.6	56 32.0 S	10.9	.18836	73	142.12	JCB
Tsawisis	27 28.4 S	18 00	Feb 5, 09	10.1, 11.0, 11.3	25 12.2 W	7.4	56 31.5 S	11.1	.18974	73	142.12	JCB
JCB 54	27 35.4 S	18 15	Feb 3, 09	9.0, 9.3	25 15.6 W	13.4	56 40.7 S	10.9	.18909	73	142.12	JCB
JCB 53	27 44.6 S	18 24	Feb 2, 09	9.0, 10.0, 13.4	25 10.8 W	7.3	56 46.4 S	11.5	.18903	73	142.12	JCB
Khamis	27 51.6 S	18 35	Feb 1, 09	9.6, 12.2	25 25.7 W	7.3	56 55.9 S	11.0	.18893	73	142.12	JCB
Gabis	28 08.5 S	18 34	Jan 31, 09	9.3, 9.7, 11.6	25 30.4 W	7.2	57 00.4 S	10.7	.18856	73	142.12	JCB
Dabai Gabis	28 19.9 S	18 40	Jan 30, 09	9.6, 9.8	25 14.0 W	7.3	57 11.1 S	10.7	.18824	73	142.12	JCB
JCB 49	28 34.7 S	18 33	Jan 27, 09	9.9	25 58.1 W	7.4	57 20.0 S	10.8	.18743	73	142.12	JCB
JCB 48*	28 44.0 S	18 25	Jan 26, 09	9.3, 9.5, 12.5	25 52.8 W	7.5	58 37.2 S	11.2	.18376	73	142.12	JCB

PORTUGUESE EAST AFRICA.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
JTM 113	14 36.0 S	34 33	Aug 23,'09	11.8, 14.0	12 04.0 W	15.1	48 52.0 S	12.8	.23842	31	9.12(46)	JTM
Mozambique	14 55 S	40 25	Sep 22, 09	.....	.....	17.4	50 14.1 S	.....	.....	..	9.1(6)	JTM
Moramhala Mountain	17 29.8 S	35 23	Sep 11, 09	10.2, 12.8	13 22.6 W	14.1	52 27.4 S	11.7	.22404	31	9.12(46)	JTM
Ntowa	17 56.3 S	35 33	Sep 13, 09	10.5, 13.9	13 25.1 W	15.6	52 54.2 S	13.1	.22209	31	9.12(46)	JTM
Mapia	18 02.7 S	35 46	Sep 14, 09	12.7	13 20.9 W	14.2	53 24.1 S	13.1	.22033	31	9.12	JTM
JTM 127	18 10.8 S	35 54	Sep 15, 09	11.7, 13.9	13 23.6 W	16.7	53 37.5 S	12.8	.21921	31	9.12	JTM
Cbinde	18 34.6 S	36 30	Sep 19, 09	10.2, 13.3	13 02.8 W	.....	.....	11.8	.21669	31	.....	JTM
			Sep 20, 09	.....	.....	10.5	53 53.6 S	.....	.....	..	9.12(46)	JTM

TRIPOLI.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Tripoli	33 53.8 N	13 40	Sep 4,'05	10.4 to 11.4(5)	9 00.6W[a]	.....	.....	12.7, 14.0	.27707[a]	D–S	.....	LP
			Sep 4, 05	16.9 to 17.9(5)	8 58.9W[a]	.....	.....	.....	.....	D–S	.....	LP
			Sep 6, 05	.....	.....	10.5, 16.8	46 52.2N[a]	.....	.....	...	D.25	LP
			Sep 7, 05	.....	.....	16.8	46 52.4N[a]	.....	.....	...	D.1	LP

[a] Correction to International Magnetic Standard not yet applied.

* Local disturbance.

AFRICA.

UGANDA.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Gondokoro	4 53.9 N	31 43	Nov 26,'09	9.0, 16.0	5 42.5 W	.....	.....	10.9	.33136	73	.....	JCB
			Nov 27, 09	.....	.....	9.1	12 32.2 S	.....	.....	..	142.1235	JCB
Kiriba	4 42.4 N	31 37	Nov 24, 09	9.3	5 42.5 W	10.3	12 57.4 S	9.6	.33103	73	142.15	JCB
Lædju's Village	4 28.1 N	31 39	Nov 22, 09	8.0, 10.3	5 51.0 W	11.2	13 28.6 S	9.3	.33038	73	142.15	JCB
Helo	4 19.6 N	31 43	Nov 20, 09	15.0	5 45.7 W	12.4	13 47.8 S	13.8	.32958	73	142.15	JCB
Uma River	4 02.8 N	31 49	Nov 17, 09	14.9	5 51.3 W	12.4	14 28.2 S	14.0	.32914	73	142.15	JCB
Kirifi	3 51.2 N	31 59	Nov 15, 09	15.5	5 49.6 W	13.0	15 01.2 S	14.4	.32786	73	142.15	JCB
Nimule	3 35.2 N	32 08	Nov 12, 09	8.8, 10.9, 16.0	5 48.2 W	12.2	15 28.0 S	10.2	.32792	73	142.15	JCB
Bugubune	3 26.1 N	32 02	Nov 10, 09	8.9, 11.0, 14.5	5 57.0 W	12.1	16 02.2 S	10.0	.32700	73	142.15	JCB
Fadimule	3 15.5 N	31 53	Nov 8, 09	15.3	5 56.4 W	12.6	16 14.8 S	15.6	.32576	73	142.15	JCB
Zoga River	3 07.6 N	31 47	Nov 7, 09	8.4, 10.3	6 01.0 W	12.0	16 29.4 S	9.4	.32630	73	142.15	JCB
Chuma	2 51.1 N	31 42	Nov 4, 09	16.7	6 11.4 W	13.1	17 17.4 S	14.6	.32479	73	142.15	JCB
Simoni	2 46.5 N	31 39	Nov 3, 09	16.0	6 11.6 W	13.6	17 19.6 S	14.7	.32454	73	142.15	JCB
Wadelai	2 41.6 N	31 35	Nov 2, 09	8.7, 10.9, 14.8	6 16.7 W	14.2	17 30.4 S	9.5	.32481	73	142.15	JCB
Dobeda	2 32.6 N	31 37	Oct 31, 09	8.2	6 16.0 W	10.6	17 49.3 S	8.6	.32472	73	142.15	JCB
Koha	2 19.3 N	31 34	Oct 27, 09	15.6	6 18.4 W	.....	.....	.....	.....	73	.....	JCB
			Oct 28, 09	8.8, 11.0, 14.5	6 19.5 W	.....	.....	9.9	.32308	73	.....	JCB
			Oct 29, 09	.....	.....	11.9	18 26.7 S	.....	.....	..	142.1235	JCB
Butiaba Port	1 49.3 N	31 23	Oct 25, 09	14.2, 15.4	6 34.7 W	9.8	19 32.3 S	12.2	.32084	73	142.1235	JCB
Hoima	1 25.6 N	31 23	Oct 22, 09	15.9	6 32.8 W	.....	.....	.....	.....	73	.....	JCB
			Oct 23, 09	9.0	6 35.1 W	10.1	20 25.4 S	8.4	.31802	73	142.15	JCB
Kikonda	(1 15) N	(31 30)	Oct 21, 09	.....	.....	15.8	20 50.8 S	16.4	.31876	73	142.15	JCB
Vailo	1 00 N	31 41	Oct 20, 09	16.9	(6 30) W	16.2	21 13.4 S	17.1	.31703	73	142.15	JCB
Kisingo	(0 53) N	(31 53)	Oct 19, 09	.....	.....	11.1	21 50.3 S	.....	.....	..	142.135	JCB
Katwe	0 45.3 N	32 05	Oct 18, 09	9.4	6 19.8 W	10.8	22 02.4 S	9.7	.31643	73	142.12	JCB
Nkanuna	0 33.1 N	32 14	Oct 17, 09	7.0, 9.0	6 36.8 W	10.9	22 20.4 S	9.1	.31452	73	142.12	JCB
Kikondua	0 26.5 N	32 22	Oct 16, 09	10.5	6 37.7 W	11.4	21 18.0 S	10.7	.31612	73	142.12	JCB
Kampala	0 18.8 N	32 32	Oct 15, 09	8.8	6 33.9 W	12.0	22 43.4 S	9.0	.31489	73	142.1	JCB
Kianja	0 10.0 N	32 14	Oct 10, 09	8.6	6 45.5 W	11.0	22 59.7 S	8.9	.31369	73	142.12	JCB
Busami	0 08.8 N	32 22	Oct 11, 09	8.3	6 45.6 W	10.8	23 10.0 S	8.7	.31345	73	142.12	JCB
Mitalla Maria*	0 04.8 N	32 07	Oct 9, 09	.....	.....	13.2	24 55.9 S	14.9	.30419	73	142.1	JCB
Entebbe	0 04.0 N	32 28	Oct 13, 09	8.4	6 46.1 W	11.3	23 22.4 S	9.9	.31336	73	142.12	JCB
Kayabui	0 00.8 S	32 00	Oct 8, 09	9.3	7 10.5 W	13.0	23 28.0 S	10.6	.31171	73	142.1235	JCB
Lukaya	0 09.4 S	31 50	Oct 7, 09	8.9	6 56.1 W	11.4	23 02.2 S	9.5	.31146	73	142.12	JCB
Masaka	0 20.2 S	31 42	Oct 5, 09	.....	.....	15.7	23 49.6 S	.....	.....	..	142.1235	JCB
			Oct 6, 09	9.3	6 41.2 W	.....	.....	10.1	.31018	73	.....	JCB
Sambia	0 34.6 S	31 34	Oct 4, 09	10.2	7 24.8 W	12.6	23 40.4 S	11.2	.31132	73	142.12	JCB
Sanje	0 45 S	31 31	Oct 3, 09	9.6	7 23.4 W	12.0	24 25.9 S	13.9	.31341	73	142.1	JCB

* Local disturbance.

ASIA.

ASIATIC RUSSIA.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Aktjubinsk	50 17.2 N	57 12	Sep 21,'09	9.2, 11.4	8 56.6 E	14.3	65 13.5 N	10.0, 11.0	.21437	5	177.1256	JCP
Emba	48 49.2 N	58 07	Sep 19, 09	9.2, 11.4	7 55.9 E	13.8	63 58.0 N	9.7, 10.7	.22217	5	177.1256	JCP
Chelkar	47 50.0 N	59 37	Sep 18, 09	9.4, 11.3	8 29.6 E	13.9	63 17.0 N	9.9, 10.8	.22809	5	177.1256	JCP
Kazalinsk	45 45.8 N	62 06	Sep 15, 09	9.0, 10.7	7 31.0 E	14.0	61 38.0 N	9.5, 10.3	.23841	5	177.1256	JCP
Perovsk	44 51.2 N	65 29	Sep 13, 09	9.6, 11.3	7 38.4 E	14.0	61 02.4 N	10.0, 10.9	.24499	5	177.1256	JCP
Turkestan	43 17.9 N	68 16	Sep 11, 09	9.6, 11.1	7 14.6 E	13.8	59 40.7 N	10.1, 10.8	.25514	5	177.1256	JCP
Chimkent	42 19.3 N	69 36	Sep 8, 09	13.5, 15.2	6 45.9 E	17.0	58 45.2 N	13.9, 14.8	.26040	5	177.12	JCP
Tashkent, Absolute Obs'y.	41 19.8 N	69 18	Sep 3, 09	11.1, 12.9	6 17.4 E	15.0	58 04.9 N	11.7, 12.5	.26371	5	177.1256	JCP
Tashkent, Outside Station.	41 19.8 N	69 18	Sep 4, 09	8.9, 9.6	6 21.0 E	.....	.....	10.3, 11.0	.26348	5	.....	JCP
			Sep 6, 09	8.4, 10.6	6 21.4 E	11.9	58 03.2 N	9.2, 10.1	.26346	5	177.12	JCP
Andijan	40 45.4 N	72 18	Aug 27, 09	8.3, 9.8	6 07.2 E	10.9	57 18.5 N	8.7, 9.4	.27199	5	177.1256	JCP
Andijan, Secondary	40 45.4 N	72 18	Aug 26, 09	17.3	6 02.0 E	16.0	57 17.4 N	17.8	.27218	5	177.12	JCP
Kokand	40 31.2 N	70 51	Aug 21, 09	10.0, 11.4	5 54.2 E	9.0	56 58.0 N	10.4, 11.1	.27319	5	177.12	JCP
Kokand, Secondary	40 31.2 N	70 51	Aug 20, 09	17.3	5 53.5 E	16.1	56 59.0 N	17.8	.27319	5	177.12	JCP
Khojend	40 17.2 N	69 32	Aug 18, 09	9.7, 11.4	5 51.2 E	8.3	56 23.8 N	10.2, 11.0	.27775	5	177.1256	JCP
Khojend, Secondary	40 17.2 N	69 32	Aug 17, 09	17.8	5 52.0 E	17.0	56 23.6 N	18.2	.27773	5	177.12	JCP
Krasnovodsk	39 59.8 N	53 03	Jul 22, 09	8.5, 10.1	4 32.6 E	14.6	55 33.1 N	8.8, 9.7	.26444	5	177.1256	JCP
Krasnovodsk, Secondary	39 59.8 N	53 03	Jul 23, 09	8.3	4 31.3 E	10.2	55 28.6 N	8.8	.26536	5	177.12	JCP
Bukhara	39 43.2 N	64 24	Aug 10, 09	9.8, 11.5	5 45.1 E	8.1	55 39.4 N	10.2, 11.1	.27340	5	177.1256	JCP
Bukhara, Secondary	39 43.2 N	64 24	Aug 9, 09	18.8	5 48.0 E	18.0	55 40.2 N	19.1	.27340	5	177.12	JCP
Samarkand	39 39.4 N	66 51	Aug 14, 09	9.7, 11.3	5 48.2 E	8.5	55 37.7 N	10.1, 10.9	.27531	5	177.1256	JCP
Samarkand, Secondary	39 39.4 N	66 51	Aug 13, 09	17.4	5 41.7 E	18.8	55 30.2 N	17.8	.27638	5	177.12	JCP
Samarkand, No. 3	39 39.4 N	66 51	Aug 16, 09	10.0	5 50.0 E	9.2	55 39.2 N	10.4	.27516	5	177.12	JCP
Charjui, A	39 05.7 N	63 40	Aug 6, 09	8.3	5 22.8 E	10.1	54 47.0 N	8.7	.27537	5	177.12	JCP
Charjui, B	39 05.7 N	63 40	Aug 5, 09	18.2	5 19.3 E	17.3	54 47.4 N	18.5	.27536	5	177.12	JCP
Kizil Arvat	38 57.8 N	56 17	Jul 26, 09	7.0	5 05.7 E	9.8	53 53.1 N	7.4	.27506	5	177.1256	JCP
Kizil Arvat, Secondary	38 57.8 N	56 17	Jul 25, 09	17.1	5 03.6 E	18.5	53 53.4 N	17.5	.27512	5	177.12	JCP
Askabad	37 56.6 N	58 24	Jul 28, 09	9.0, 10.6	4 56.1 E	14.2	52 57.8 N	9.4, 10.2	.27998	5	177.1256	JCP
Merv	37 35.8 N	61 54	Aug 3, 09	9.6, 11.2	4 48.6 E	8.0	53 02.0 N	10.0, 10.8	.28231	5	177.1256	JCP
Merv, Secondary	37 35.8 N	61 54	Aug 2, 09	17.2	4 49.4 E	18.6	53 00.5 N	17.6	.28252	5	177.12	JCP
Dushak	37 12.1 N	60 04	Jul 30, 09	9.8, 11.6	4 41.1 E	8.1	52 12.4 N	10.3, 11.2	.28521	5	177.1256	JCP
Aschur-Adé, A	36 54.2 N	53 54	Jul 15, 09	7.7	3 57.5 E	10.9	51 17.3 N	8.1	.28144	5	177.12	JCP
Aschur-Adé, B	36 54.2 N	53 54	Jul 15, 09	17.9	3 54.6 E	16.7	51 16.4 N	18.2	.28178	5	177.12	CP

CHINA.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Tszmechuan	44 12.4 N	88 16	May 21,'09	14.0, 14.8	5 28.4 E	11.0	62 16.4 N	14.4	.25669	10	171.(567)	DCS
Kucheng	44 01.2 N	89 23	May 18, 09	.....	.....	16.8	62 13.5 N	.....	.....	..	171.(567)	DCS
			May 19, 09	5.8, 7.0, 7.3	5 08.7 E	.....	.....	6.2, 6.7	.25672	10	.....	DCS
Muliho	44 00 N	90 06	May 16, 09	.....	.....	15.3	61 55.2 N	.....	.....	..	171.(567)	DCS
Tihuafu	43 46.9 N	87 26	May 26, 09	.....	.....	16.4(wt.3)	61 43.1 N	13.0, 13.6	.25896	10	171.(567)	DCS
			May 27, 09	8.1 to 17.0(d.v.)	5 39.7 E	9.0(wt.2)	61 48.4 N	.....	.....	10	171.(56)	S&F
Tashitu	43 44.9 N	91 06	May 14, 09	13.7, 14.9	3 45.6 E	16.5	61 47.3 N	14.0, 14.6	.26268	10	171.(567)	DCS
Chergolochuan	43 26.7 N	91 49	May 12, 09	10.3, 11.4	4 38.0 E	10.6	61 53.1 N	11.0	*.2597*	*171*	171.(56)	DCS
Dawanchin	43 21.0 N	88 09	Jun 4, 09	15.2, 16.5	5 17.2 E	15.6	61 13.7 N	16.1	*.2638*	*171*	171.(567)	DCS
Shantaoling	43 07.6 N	92 39	May 9, 09	15.5, 16.3	4 06.4 E	14.1	61 23.3 N	15.8	.26448	10	171.(567)	DCS
Turfan	42 56.9 N	89 05	Jun 8, 09	9.0, 10.3	5 07.2 E	7.8	60 56.6 N	9.4, 10.0	.26550	10	171.(567)	DCS
Hami	42 49.2 N	93 29	May 6, 09	10.4, 12.5	3 47.6 E	16.8	61 14.7 N	10.8, 11.4	.26514	10	171.(567)	DCS
Tukson	42 48.1 N	88 35	Jun 11, 09	8.3, 9.5	5 10.2 E	6.5	60 52.3 N	8.7, 9.2	.26616	10	171.(567)	S&F
Akrabulak	42 29.6 N	88 29	Jun 15, 09	5.2	5 10.6 E	5.5	60 13.7 N	6.0	*.2690*	*171*	171.(56)	DCS
Jentun	42 21.6 N	94 10	May 4, 09	9.5, 11.3	3 53.7 E	8.2	60 34.4 N	9.8, 10.4	.27016	10	171.(567)	DCS
Koomish	42 14.2 N	88 08	Jun 16, 09	9.3, 10.3	5 08.6 E	11.0	59 55.9 N	9.7	.27014	10	171.(567)	DCS
Ushtalla	42 12.5 N	87 14	Jun 18, 09	12.4, 13.9	5 18.0 E	12.9	59 50.7 N	13.6	*.2709*	*171*	171.(567)	DCS
Karashar	42 04.1 N	86 32	Jun 21, 09	8.0, 9.4	5 24.0 E	5.8	59 50.2 N	8.3, 9.1	.26973	10	171.(567)	DCS
Yangsar	41 56.8 N	84 35	Jun 27, 09	9.8, 11.4	5 40.3 E	14.3	59 27.8 N	10.2, 11.0	.27066	10	171.(567)	DCS
Charkee	41 55.5 N	85 27	Jun 25, 09	9.5, 11.5, 15.5	5 28.1 E	10.3	59 26.1 N	10.9	*.2716*	*171*	171.(567)	S&F
Hotzar	41 49.7 N	82 28	Jul 5, 09	9.8, 11.4	5 45.2 E	10.4	59 19.1 N	11.1	*.2694*	*171*	171.(567)	DCS
Erpatai	41 49.1 N	83 49	Jun 29, 09	12.4, 14.2	5 29.1 E	12.9	59 13.3 N	13.7	*.2712*	*171*	171.(567)	DCS
Korla	41 45.3 N	86 08	Jun 23, 09	15.8, 16.5	5 22.2 E	17.0	59 20.4 N	16.1	.27259	10	171.(567)	DCS
Kucha	41 43.4 N	82 56	Jul 2, 09	.....	.....	5.9, 12.6	59 08.5 N	9.2, 10.1	.27106	10	171.(567)	DCS
			Jul 3, 09	5.2 to 14.7(d.v.)	5 38.6 E	.....	.....	.....	.....	10	.....	S&F
Chwanchensa	41 43 N	94 53	May 2, 09	6.6, 8.1	2 53.0 E	7.0	59 36.1 N	7.7	*.2803*	*171*	171.(567)	DCS
Haimitszyi	41 39.9 N	81 36	Jul 7, 09	10.6, 11.6	6 02.0 E	14.0	58 59.6 N	11.1	.27074	10	171.(56)	S&F
Holai-e-kuan	41 20 N	80 58	Jul 9, 09	15.0, 16.3	5 59.6 E	15.4	58 37.3 N	16.0	*.2738*	*171*	171.(567)	DCS
Aksu	41 10.5 N	80 19	Jul 12, 09	5.7, 7.0	5 57.5 E	10.1	58 20.8 N	6.0, 6.7	.27369	10	171.(567)	DCS

ASIA.

CHINA—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Chinchowfu	41 05.0 N	121 08	Sep 26,'07	.....	.....	16.3	58 18.0 N	.....	.....	..	171.(56)	CKE
			Sep 27, 07	11.3, 12.4	5 23.3 W	.....	.....	11.7	.28235	2	.....	CKE
Hunlungtsz	41 03.9 N	95 35	Apr 28, 09	13.2, 14.2	3 30.2 E	14.9	59 32.3 N	13.7	.27124	10	171.(567)	DCS
Chol Koda	40 43.9 N	80 00	Jul 16, 09	9.5, 10.9	5 45.6 E	9.9	57 46.4 N	10.5	*.2754*	*171*	171.(567)	DCS
Newchwang	40 39.0 N	122 12	Sep 24, 07	9.7, 11.8	4 58.9 W	16.8	57 38.4 N	10.4, 11.4	.28366	2	171.(56)	CKE
Ansichow	40 33.2 N	95 55	Apr 23, 09	7.4, 8.7	2 38.1 E	10.3	58 43.6 N	7.7, 8.4	.28128	10	171.(567)	DCS
Bulungir	40 31.8 N	96 39	Apr 21, 09	6.2, 7.0, 7.2	2 48.0 E	8.2	58 21.9 N	6.6	.28367	10	171.(56)	DCS
Yakakudk	40 11.4 N	79 30	Jul 18, 09	14.0, 15.2	4 57.2 E	15.7	57 27.4 N	14.4, 14.9	.27646	10	171.(567)	DCS
Chui Chin	40 03.7 N	97 28	Apr 19, 09	6.2, 7.1	2 30.2 E	8.0	57 57.5 N	6.6	.28757	10	171.(56)	DCS
Shanhaikwan	39 58.3 N	119 45	Sep 28, 07	14.8, 16.6	4 46.9 W	.....	.....	14.3, 16.2	.29036	2	.....	CKE
			Sep 29, 07	.....	.....	8.4	57 05.4 N	.....	.....	..	171.(56)	CKE
Tumschuk	39 58.0 N	79 09	Jul 19, 09	7.2, 8.3	5 21.6 E	7.6	57 10.4 N	8.6	*.2788*	*171*	171.(567)	DCS
Peking	39 56.6 N	116 25	Oct 7, 07	14.0, 16.2	3 38.4 W	10.9	57 15.4 N	14.5, 15.7	.28991	2	171.(56)	CKE
			Jan 6, 09	11.1, 13.2	3 30.4 W	14.3	57 19.1 N	11.6, 12.7	.28935	10	171.(567)	DCS
			Jan 7, 09	10.3, 11.7	3 29.8 W	13.9	57 25.8 N	10.7, 11.4	.28921	10	171.(567)	DCS
Maralbashi	39 47.3 N	78 34	Jul 21, 09	9.9, 11.0	5 28.6 E	12.9	56 50.0 N	10.2, 10.8	.27982	10	171.(567)	DCS
Yenche	39 45.2 N	99 23	Apr 10, 09	15.2, 16.0	1 49.7 E	17.2	57 31.7 N	15.5	.29044	10	171.(567)	DCS
Suchow	39 44.6 N	98 37	Apr 14, 09	8.8, 10.1	2 03.8 E	10.9	57 29.4 N	9.2, 9.8	.28955	10	171.(567)	DCS
Suchow, Secondary	39 44.6 N	98 38	Apr 13, 09	9.9 to 17.6 (d.v.)	2 00.0 E	.....	.....	.....	.....	10	.....	DCS
Kalakusk	39 44.6 N	78 02	Jul 23, 09	9.7, 11.3	5 27.4 E	10.0	56 45.8 N	10.7	*.2793*	*171*	171.(56)	S&F
Lungko	39 37.7 N	77 15	Jul 25, 09	10.4, 11.6	5 44.2 E	13.0	56 34.1 N	10.8, 11.4	.28028	10	171.(567)	S&F
Kashgar	39 28.3 N	75 58	Jul 29, 09	.....	.....	13.0	56 16.8 N	11.6	.28101	10	171.(567)	DCS
			Jul 30, 09	5.0 to 15.0 (d.v.)	5 40.4 E	6.5	56 22.3 N	16.0, 16.6	.28101	10	171.(567)	DCS
Faizabad	39 28 N	76 44	Jul 26, 09	13.2, 14.9	5 30.5 E	13.6	56 18.1 N	14.3	*.2816*	*171*	171.(567)	DCS
Kaotai	39 22.1 N	99 54	Apr 9, 09	6.7, 7.5	1 31.0 E	8.5	57 10.2 N	7.0	.29225	10	171.(56)	DCS
Tientsin	39 05.3 N	117 12	Oct 2, 07	13.0, 14.2	3 25.6 W	11.0	56 20.1 N	13.6 (wt.½)	.29355	2	171.(56)	CKE
			Oct 3, 07	.....	.....	.....	.....	9.0, 10.0	.29326	2	.....	CKE
Kanchow	38 56.6 N	100 32	Apr 6, 09	7.6, 8.9	1 31.6 E	10.7	56 35.9 N	8.0, 8.6	.29516	10	171.(567)	DCS
Yangihissar	38 56.2 N	76 10	Aug 6, 09	11.0, 13.1	5 24.8 E	11.5	55 18.9 N	12.6	*.2858*	*171*	171.(567)	DCS
Shandanshien	38 46.7 N	101 13	Apr 4, 09	11.6	1 00.4 E	12.5	56 26.0 N	.....	.....	*171*	171.(56)	DCS
Yarkand	38 24.1 N	77 16	Aug 9, 09	10.2, 11.5	5 10.3 E	13.1	54 53.8 N	10.5, 11.2	.28820	10	171.(567)	DCS
Shin Chuanli	38 21.5 N	101 45	Apr 2, 09	17.7	1 11.7 E	18.1	55 47.6 N	17.3	*.2995*	*171*	171.(56)	DCS
Howki Island	38 03.8 N	120 39	Sep 22, 07	.....	.....	16.0	54 35.3 N	13.8	.29990	2	171.(56)	CKE
Chentow	38 03.3 N	114 26	Oct 16, 07	9.2, 11.4	2 36.6 W	15.7	55 14.4 N	9.9, 11.0	.30036	2	171.(56)	CKE
Liangchowfu	37 56.8 N	102 45	Mar 29, 09	10.1, 12.5	0 47.2 E	14.9	55 20.3 N	11.0, 11.6	.30110	10	171.(567)	DCS
Kargalik	37 53.4 N	77 35	Aug 13, 09	9.8, 11.1	5 04.6 E	7.6	54 21.6 N	10.2, 10.8	.29165	10	171.(567)	DCS
Taiyuanfu	37 51.9 N	112 33	Oct 12, 07	.....	.....	17.1	55 04.8 N	.....	.....	..	171.(5)	CKΣ
			Oct 14, 07	10.0, 12.0	2 09.8 W	.....	.....	10.6, 11.7	.30120	2	.....	CKE
Goma	37 38.9 N	78 17	Aug 15, 09	9.6, 11.7	4 44.2 E	10.1	53 57.5 N	11.4	*.2949*	*171*	171.(567)	DCS
Kungtungtao	37 30.5 N	121 31	Sep 19, 07	.....	.....	8.6	53 52.0 N	10.0, 10.5	.30234	2	171.(56)	CKE
Chefoo	37 29 N	121 24	Sep 20, 07	11.1, 14.0	4 24.0 W	17.6	53 48.4 N	11.6, 13.2	.30188	2	171.(56)	CKE
Northeast Promontory	37 23.0 N	122 38	Sep 18, 07	9.5, 11.6	4 23.8 W	.....	.....	10.0, 11.1	.29911	2	.....	CKE
Pialma	37 18.6 N	79 10	Aug 17, 09	15.5, 16.3	4 47.2 E	16.8	53 44.7 N	15.8	.29606	10	171.(567)	DCS
Kilian	37 15 N	77 55	Aug 31, 09	.....	.....	15.9	53 22.8 N	16.4	*.2975*	*171*	171.(56)	DCS
Chengchang	37 09.5 N	103 01	Mar 26, 09	10.9, 12.5	0 36.6 E	11.3	54 15.4 N	11.7	*.3078*	*171*	171.(56)	DCS
Khotan	37 07.6 N	79 58	Aug 19, 09	14.8, 16.8	4 23.0 E	11.2	53 18.7 N	15.3, 16.5	.29892	10	171.(567)	DCS
Akshua	37 04.4 N	77 55	Sep 3, 09	8.7, 10.0	4 39.8 E	9.1	53 08.0 N	9.6	*.2959*	*171*	171.(56)	S&F
Camp Makeshift	36 55.1 N	78 20	Sep 10, 09	9.4, 10.5	4 29.9 E	9.7	53 07.1 N	10.1	*.2973*	*171*	171.(56)	DCS
Southeast Promontory	36 54 N	122 32	Sep 16, 07	.....	.....	16.5	52 42.1 N	.....	.....	..	171.(56)	CKE
			Sep 17, 07	.....	.....	.....	.....	10.5, 12.0	.30878	2	.....	CKE
			Sep 17, 07	.....	.....	.....	.....	14.2	.30915	2	.....	CKE
Weihsien	36 42.4 N	119 01	Oct 12, 08	.....	.....	15.3, 16.4	53 07.0 N	.....	.....	..	171.(5678)	CKE
			Oct 13, 08	9.5, 11.9	3 40.5 W	.....	.....	10.1, 11.4	.30733	2	.....	CKE
			Oct 14, 08	16.9, 17.3	3 38.8 W	.....	.....	.....	.....	2	.....	CKE
Pingfan	36 41 N	103 26	Mar 24, 09	15.1, 17.5	0 33.6 E	16.3	53 45.8 N	17.0	*.3096*	*171*	171.(567)	DCS
Togiamanlak	36 32 N	78 13	Sep 13, 09	15.5	4 34.3 E	16.0	52 30.6 N	16.7	*.3004*	*171*	171.(56)	S&F
Changte Ho	36 05.6 N	114 18	Oct 18, 07	9.4, 11.5	2 23.8 W	14.6	52 32.1 N	10.0, 11.2	.31221	2	171.(56)	CKE
Tsingtau	36 04.2 N	120 19	Oct 9, 08	14.5, 16.9	3 48.1 W	.....	.....	15.3, 16.4	.30766	2	.....	CKE
			Oct 10, 08	.....	.....	9.6	52 21.5 N	.....	.....	..	171.(5678)	CKE
Lanchowiu	36 04.6 N	103 58	Mar 16, 09	10.3, 11.7	0 22.1 E	14.8	52 44.8 N	10.6, 11.2	.31399	10	171.(567)	DCS
			Mar 18, 09	.....	.....	10.1	52 47.6 N	.....	.....	..	171.(567)	DCS
Lanchowfu, Secondary	36 04 N	103 57	Mar 15, 09	8.6 to 18.0 (d.v.)	0 20.1 E	.....	.....	.....	.....	10	.....	DCS
Hweining	35 42.3 N	105 09	Mar 8, 09	12.9, 14.2	0 08.5 E	10.2	52 32.9 N	13.2, 13.9	.31545	10	171.(567)	DCS
Pingliang	35 33.3 N	106 46	Mar 2, 09	10.3, 11.8	0 12.3 W	13.9	52 11.0 N	10.9, 11.4	.31700	10	171.(567)	DCS
Tsining	35 23.0 N	116 26	Oct 31, 08	13.8, 16.4	2 20.0 W	.....	.....	14.5, 15.8	.32074	2	.....	CKE
			Nov 2, 08	.....	.....	10.1, 15.3	51 27.5 N	.....	.....	..	171.(5678)	CKE
Shenchow	34 48.2 N	111 09	Feb 9, 09	15.3, 16.8	1 29.4 W	.....	.....	15.7, 16.4	.32168	10	.....	DCS
			Feb 10, 09	.....	.....	8.5	50 53.0 N	.....	.....	..	171.(567)	DCS

ASIA.

CHINA—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Chengchow	34 44.2 N	113 36	Oct 22,'07	.....	.....	16.8	50 58.4 N	.....	.....	..	171.(56)	CKE
			Oct 23, 07	9.6, 11.6	2 01.5 W	.....	.....	10.1, 11.2	.31978	2	.....	CKE
			Feb 1, 09	9.4, 11.2	2 04.1 W	8.4	50 55.2 N	9.9, 10.8	.31975	10	171.(567)	DCS
Honanfu	34 41.2 N	112 26	Feb 3, 09	.....	.....	16.6	50 49.5 N	.....	.....	..	171.(567)	DCS
			Feb 4, 09	9.7, 11.0	1 42.7 W	.....	.....	10.1, 10.7	.32080	10	.....	DCS
Tungkwan	34 36.4 N	110 17	Feb 13, 09	7.4, 9.0	0 53.3 W	9.7	50 35.6 N	7.7, 8.5	.32512	10	171.(567)	DCS
Hanchwang	34 34 N	117 23	Nov 7, 08	.....	.....	10.5, 11.6	50 27.6 N	.....	.....	..	171.(5678)	CKE
Taierhchwang	34 33.1 N	117 37	Nov 9, 08	.....	.....	14.1	50 35.8 N	.....	.....	..	171.(5678)	CKE
			Nov 10, 08	9.5, 13.3	3 13.4 W	.....	.....	10.8, 12.3	.31814	2	.....	CKE
Sianfu	34 16.3 N	108 57	Feb 17, 09	16.2, 17.5	0 38.2 W	.....	.....	16.5, 17.2	.32326	10	.....	DCS
			Feb 18, 09	.....	.....	10.6	50 26.6 N	.....	.....	..	171.(56)	DCS
Tsingkiangpu	33 34 N	118 56	Nov 14, 08	.....	.....	16.2	49 02.9 N	.....	.....	..	171.(56)	CKE
			Nov 16, 08	14.4, 16.5	3 07.4 W	.....	.....	15.0, 16.1	.32375	2	.....	CKE
			Nov 17, 08	.....	.....	9.2	48 57.4 N	.....	.....	..	171.(78)	CKE
Chumatien	32 56 N	114 08	Oct 25, 07	.....	.....	12.3	48 18.8 N	9.9, 10.8	.32907	2	171.(56)	CKE
Yangchow	32 22 N	119 24	Jul 31, 06	10.4, 11.8, 15.5	2 46.7 W	16.7	47 04 N	11.1	.32723	24	20.2	CKE
Chinkiang	32 12 N	119 24	Aug 2, 06	10.4, 12.2	2 53.6 W	16.1	46 55.2 N	11.0, 11.8	.32974	24	20.2	CKE
			Aug 3, 06	.....	.....	10.6	46 56.9 N	.....	.....	..	20.2	CKE
			Nov 18, 08	14.5, 16.5	2 58.0 W	.....	.....	15.0, 16.0	.32994	2	.....	CKE
			Nov 19, 08	.....	.....	10.8, 11.5	47 03.5 N	.....	.....	..	171.(5678)	CKE
Chinkiang, B*	32 12 N	119 24	Aug 3, 06	.....	.....	17.1	47 31.2 N	18.6	.32602	24	20.2	CKE
			Aug 4, 06	.....	.....	16.4	47 33.8 N	.....	.....	..	20.2	CKE
Nanking	32 03.8 N	118 48	Sep 8, 07	.....	.....	6.4	46 51.4 N	.....	.....	..	171.56	CKE
			Sep 9, 07	6.4	1 50.2 W	.....	.....	7.8	.33093	2	.....	CKE
Liuchias	31 29.7 N	121 42	Aug 26, 06	9.9, 11.8	3 05.4 W	15.8	45 31 N	10.4, 11.5	.33264	24	20.2	CKE
Shaweishan	31 25.3 N	122 15	Aug 25, 06	11.6, 13.0, 15.0	2 57.2 W	16.7	46 47 N	12.2, 14.0	.32418	24	20.2	CKE
Woosung, 13	31 22 N	121 31	May 21, 07	11.0, 12.2	2 52.1 W	12.6	45 36.4 N	11.5	.33117	1	178.12	G III
Woosung, 12	31 21.4 N	121 30	May 21, 07	15.0, 16.4, 17.0	2 49.8 W	17.7	45 32.0 N	15.5, 16.0	.33202	1	178.12	G III
			May 23, 07	.....	.....	9.5 (wt. ½)	45 27.3 N	.....	.....	..	35.12	G III
Wuhu, B	31 21.1 N	118 20	Sep 5, 07	.....	.....	.....	.....	15.5	.33974	2	.....	CKE
Wuhu	31 21.1 N	118 20	Sep 6, 07	10.2, 16.2	2 32.7 W	19.3	46 01.2 N	11.0, 15.5	.33961	2	171.(5)	CKE
Soochow	31 20.3 N	120 39	Aug 11, 06	10.2, 11.9, 14.7	2 30.1 W	15.7	45 43 N	10.6, 11.6	.33186	24	20.2	CKE
Zikawei Obs'y, Absolute House	31 11.5 N	121 26	May 14, 07	14.0, 15.4	2 36.6 W	.....	.....	14.5, 15.0	.33087	1	.....	G III
			May 15, 07	.....	.....	15.1	45 35.9 N	.....	.....	..	35.12	G III
			May 15, 07	.....	.....	17.0	45 41.9 N	.....	.....	..	169.12	G III
			May 17, 07	.....	.....	9.7, 11.0	45 35.0 N	.....	.....	..	35.12	G III
			May 17, 07	.....	.....	16.5	45 41.3 N	.....	.....	..	169.12	G III
			May 18, 07	.....	.....	9.2	45 36.9 N	.....	.....	..	178.12	G III
			Aug 23, 07	.....	.....	15.9, 17.7	45 38.4 N	.....	.....	..	171.(56)	CKE
			Aug 24, 07	.....	.....	15.4, 17.2	45 39 N	.....	.....	..	20.2	CKE
			Sep 12, 07	9.8, 12.2	2 37.3 W	.....	.....	10.3, 11.7	.33022	2	.....	CKE
Zikawei Obs'y, N.	31 11.5 N	121 26	Aug 7, 06	9.9, 12.0	2 30.0 W	15.3	45 36 N	10.5, 11.4	.33074	24	20.2	CKE
			Aug 8, 06	9.8, 11.7	2 32.2 W	16.6	45 38 N	10.4, 11.4	.32998	24	20.2	CKE
			Sep 14, 06	9.8, 11.6	2 32.0 W	16.1	45 34 N	10.3, 11.1	.33013	24	20.2	CKE
			May 14, 07	10.1, 11.6	2 35.6 W	16.4	45 38.6 N	10.6, 11.1	.33048	1	178.12	G III
			May 15, 07	10.8, 12.0	2 38.4 W	.....	.....	11.2, 11.7	.33095	1	.....	G III
			May 17, 07	.....	.....	10.2, 11.5	45 39.8 N	.....	.....	..	169.12	G III
			May 18, 07	.....	.....	11.2	45 36.8 N	.....	.....	..	178.12	G III
			Aug 23, 07	.....	.....	15.6, 16.2	45 38 N	.....	.....	..	20.2	CKE
			Aug 24, 07	.....	.....	17.2	45 38.5 N	.....	.....	..	171.(56)	CKE
			Sep 11, 07	11.2, 15.1, 17.6	2 35.9 W	.....	.....	11.8, 15.6	.33103	2	.....	CKE
			Sep 11 ,07	.....	.....	.....	.....	17.1	.33048	2	.....	CKE
			Sep 12, 07	15.1, 17.6	2 35.4 W	.....	.....	15.6, 17.2	.33028	2	.....	CKE
			Sep 14, 07	.....	.....	11.3	45 35.8 N	.....	.....	..	171.(6)	CKE
Zikawei Obs'y, S.	31 11.5 N	121 26	Aug 7, 06	.....	.....	16.8	45 33 N	.....	.....	..	20.2	CKE
			Sep 14, 06	.....	.....	16.9	45 37 N	.....	.....	..	20.2	CKE
			Aug 23, 07	.....	.....	17.4, 17.9	45 36 N	.....	.....	..	20.2	CKE
			Aug 24, 07	.....	.....	15.4	45 36.4 N	.....	.....	..	171.(56)	CKE
			Sep 14, 07	.....	.....	11.3	45 41.5 N	.....	.....	..	171.(5)	CKE
North Saddle	30 51.9 N	122 40	Aug 24, 06	10.3, 12.4	3 04.6 W	17.4	45 10 N	10.8, 11.6	.33071	24	20.2	CKE
Gutzlaff	30 48.6 N	122 10	Aug 14, 06	.....	.....	12.4	46 16 N	.....	.....	..	20.2	CKE
			Aug 23, 06	.....	.....	16.5	46 14 N	.....	.....	..	20.2	CKE
Mokanshan	30 38 N	119 44	Sep 9, 06	.....	.....	14.8	44 38 N	12.5	.33508	24	20.2	CKE
Bonham Island	30 37 N	122 25	Aug 14, 06	.....	.....	17.6	44 46 N	.....	.....	..	20.2	CKE
			Aug 15, 06	8.9, 11.2	2 42.6 W	.....	.....	9.5, 10.7	.33404	24	.....	CKE

*Local disturbance.

ASIA.

CHINA—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Hankow	30 36.4 N	114 11	Oct 29,'07	14.7, 16.0	1 25.6 W	17.0	44 57.5 N	15.4	.34085	2	171.(56)	CKE
Hangchow	30 16 N	120 08	Sep 10, 06	.....	.....	15.8	43 59 N	.....	.....	..	20.2	CKE
			Sep 11, 06	10.1, 11.5	2 29.4 W	.....	.....	10.8	.33616	24	.....	CKE
Putu Island	29 59.8 N	122 23	Aug 16, 06	9.8, 11.3	2 34.6 W	17.0	44 43 N	10.7	.33578	24	20.2	CKE
			Aug 22, 06	.....	.....	16.4	44 45 N	.....	.....	..	20.2	CKE
Ningpo	29 53.5 N	121 34	Aug 31, 06	.....	.....	17.3	43 20 N	.....	.....	..	20.2	CKE
			Sep 1, 06	10.6, 12.9	2 44.7 W	.....	.....	11.5, 12.5	.33722	24	.....	CKE
Kiukiang	29 43.7 N	115 54	Oct 30, 07	12.6, 14.3	1 38.7 W	15.7	43 28.8 N	13.1, 14.0	.34386	2	171.(56)	CKE
Kunsuwan	29 27.5 N	122 11	Aug 20, 06	9.6, 11.5	2 14.1 W	16.3	44 59 N	10.2, 11.0	.33304	24	20.2	CKE
Peiyushan	28 54 N	122 14	Aug 18, 06	.....	.....	18.4	42 04 N	.....	.....	..	20.2	CKE
			Aug 19, 06	8.9, 11.1, 14.2	2 01.0 W	.....	.....	10.1, 10.8	.33562	24	.....	CKE
Nanchang	28 41.7 N	115 51	Nov 24, 08	.....	.....	11.7, 16.5	41 49.6 N	.....	.....	..	171.(5678)	CKE
			Nov 25, 08	9.9, 12.5	1 27.8 W	.....	.....	10.5, 11.8	.34821	2	.....	CKE
Changsha	28 12.8 N	112 53	Nov 4, 07	.....	.....	16.5	41 11.2 N	.....	.....	..	171.(56)	CKE
			Nov 5, 07	10.8, 11.3	0 50.3 W	.....	.....	11.0, 16.1	.35212	2	.....	CKE
Hengchow	26 56 N	112 35	Nov 16, 07	.....	.....	.....	.....	10.9	.35774	2	.....	CKE
			Nov 19, 07	.....	.....	8.8	39 04.4 N	.....	.....	..	171.(5)	CKE
Yungchow	26 10 N	111 55	Nov 25, 07	.....	.....	16.1	37 55.4 N	.....	.....	..	171.(56)	CKE
			Nov 26, 07	.....	.....	.....	.....	10.4	.36105	2	171.(56)	CKE
Foochow	26 02.2 N	119 16	Jul 14, 06	10.6, 12.4, 16.2	1 23.1 W	.....	.....	11.4, 16.3	.35349	24	.....	CKE
			Jul 16, 06	.....	.....	15.7	37 40 N	.....	.....	..	20.2	CKE
An Tau	25 27.3 N	119 02	Jul 18, 06	13.9, 15.8	1 02.1 W	17.3	36 44 N	15.0	.35640	24	20.2	CKE
			Jul 19, 06	7.2, 9.0	0 55.7 W	.....	.....	8.3	.35582	24	.....	CKE
Kweilin	25 17.7 N	110 12	Dec 4, 07	9.7, 11.7	0 04.6 W	14.8	36 13.2 N	10.2, 11.2	.36594	2	171.(56)	CKE
Chuanchow	24 54.7 N	118 40	Jul 10, 06	10.3, 11.6	0 46.6 W	16.4	35 23 N	11.0	.36000	24	20.2	CKE
Amoy	24 26.6 N	118 07	Jul 7, 06	10.1, 12.1	0 43.8 W	15.5	35 04 N	10.7, 11.6	.35963	24	20.2	CKE
			Jul 12, 06	9.9, 11.0	0 42.8 W	.....	.....	10.5	.35953	24	.....	CKE
Chaochowfu	23 39.5 N	116 41	Jul 4, 06	9.0, 11.2	0 21.8 W	14.1	33 23 N	9.7, 10.8	.36646	24	20.2	CKE
Wuchow	23 27.7 N	111 17	Dec 12, 07	14.4, 16.2	0 02.8 W	11.3	32 45.0 N	14.9, 15.9	.37122	2	171.(56)	CKE
Swatow	23 21.2 N	116 44	Jul 2, 06	11.1, 12.5, 14.2	0 28.2 W	18.3	33 01 N	13.0, 13.8	.36629	24	20.2	CKE
Canton, 1	23 06.1 N	113 19	Feb 26, 06	.....	.....	17.2	32 17.7 N	.....	.....	..	71.7	CKE
			Mar 1, 06	.....	.....	16.8	32 16.6 N	.....	.....	..	71.78	CKE
			Mar 2, 06	16.1, 18.5	0 00.4 E	.....	.....	17.3	.37019	55	.....	CKE
			Mar 3, 06	10.5, 14.6	0 00.4 E	.....	.....	11.8, 13.8	.37032	55	.....	CKE
Canton, 2	23 06.1 N	113 19	Jun 23, 06	8.7, 11.5	0 01.1 E	16.2	32 20 N	9.6, 10.9	.37038	24	20.2	CKE
			Jun 25, 06	11.1, 13.8	0 01.3 W	.....	.....	11.9, 13.2	.37030	24	.....	CKE
			Oct 13, 06	10.7, 12.2	0 00.6 W	16.1	32 20 N	11.2, 11.9	.37066	24	20.2	CKE
			Nov 3, 06	10.6, 12.3	0 01.8 W	15.9, 16.6	32 19 N	11.1, 11.9	.37050	24	20.2	CKE
			Nov 24, 06	9.7 to 17.0(4)	0 01.4 W	.....	.....	10.6, 11.8	.37012	24	.....	CKE
			Dec 1, 06	9.2, 10.6	0 01.2 W	.....	.....	9.9 (wt.½)	.37079	24	.....	CKE
			Dec 22, 06	9.7, 12.9	0 01.9 W	16.0	32 16 N	10.4, 12.5	.37024	24	20.2	CKE
			Jan 5, 07	8.4, 10.8	0 00.4 W	12.4	32 14 N	9.3, 10.4	.37068	24	20.2	CKE
			Feb 2, 07	11.9, 16.5	0 00.6 W	.....	.....	13.0, 16.0	.37066	24	.....	CKE
			Aug 1, 07	.....	.....	.....	.....	10.4, 11.4	.37060	24	.....	CKE
			Aug 2, 07	.....	.....	.....	.....	15.5	.37068	24	.....	CKE
			Aug 2, 07	.....	.....	.....	.....	10.8, 18.2	.37020*	2	.....	CKE
Canton, 3	23 06.1 N	113 19	Sep 28, 08	13.8, 16.2	0 06.3 W	.....	.....	15.5, 15.8	.37106	2	.....	CKE
			Oct 1, 08	.....	.....	9.4, 10.5	32 14.0 N	.....	.....	..	171.(5678)	CKE
			Dec 10, 08	.....	.....	9.7	32 06.6 N	.....	.....	..	171.(567)	DCS
			Dec 11, 08	.....	.....	11.5, 14.2	32 06.1 N	.....	.....	..	171.(567)	DCS
			Dec 12, 08	.....	.....	16.1	32 03.8 N	.....	.....	..	171.(567)	DCS
			Dec 14, 08	9.7 to 13.5(4)	0 05.1 W	.....	.....	10.7, 12.7	.37143	2	.....	CKE
			Dec 14, 08	15.2, 16.9	0 05.4 W	.....	.....	15.7, 16.5	.37156	10	.....	DCS
			Dec 15, 08	13.5, 14.9	0 05.8 W	.....	.....	13.8, 14.5	.37138	2	.....	CKE
			Dec 15, 08	8.3 to 12.1(4)	0 05.5 W	.....	.....	9.3, 11.4	.37155	10	.....	DCS
Canton, 4	23 06.1 N	113 19	Dec 14, 08	9.8 to 13.5(4)	0 04.9 W	.....	.....	10.7, 12.7	.37134	10	.....	DCS
			Dec 14, 08	15.2, 16.9	0 05.2 W	.....	.....	15.7, 16.5	.37111	2	.....	CKE
			Dec 15, 08	8.3 to 12.1(4)	0 05.3 W	.....	.....	9.4, 11.4	.37131	2	.....	CKE
			Dec 15, 08	13.5, 14.9	0 05.6 W	.....	.....	13.8, 14.5	.37169	10	.....	DCS
Hongkong Obs'y, N. Pier	22 19.2 N	114 10	Jan 17, 06	12.7, 17.7	0 11.0 E	.....	.....	16.3	.37012	55	.....	CKE
			Feb 20, 06	.....	.....	16 3	31 07.0 N	.....	.....	..	71.78	CKE
			Feb 21, 06	18.6	0 10.6 E	.....	.....	16.7	.37028	55	.....	CKE
			May 19, 06	15.0, 18.2	0 14.9 E	.....	.....	17.1	.37008	24	.....	CKE
			May 21, 06	11.4, 14.8	0 13.4 E	9.4	31 04 N	12.2, 14.3	.37015	24	20.2	CKE
			Dec 14, 06	10.6, 11.8	0 11.2 E	.....	.....	15.8	.37125	55	.....	CKE

* Weight 4.

ASIA.

CHINA—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Hongkong Obs'y N. Pier..	22 19.2 N	114 10	Dec 15,'06	.....	.....	.....	.....	12.1	.37132	55	.....	CKE
			Jan 12, 07	.....	.....	15.5	31 04.6 N	.....	.....	..	71.7	CKE
			Jan 13, 07	.....	.....	13.2	31 02.2 N	.....	.....	..	71.78	CKE
			Aug 6 to Aug 15, 07	.....	.....	.....	.....	Various (13)	.37098	2	.....	CKE
			Aug 12, 07	.....	.....	.....	.....	16.0, 17.3	.37082	24	.....	CKE
			Dec 23, 08	10.1, 15.9	0 05.8 E	.....	.....	10.8, 15.0	.37157	10	.....	DCS
			Dec 24, 08	12.5	0 04.8 E	.....	.....	10.1	.37152	10	.....	DCS
Hongkong Obs'y, S. Pier..	22 19.2 N	114 10	Dec 14, 06	10.2, 11.1, 12.3	0 08.5 E	.....	.....	15.9(wt.½)	.37042	24	.....	CKE
			Dec 15, 06	.....	.....	.....	.....	12.1	.37044	24	.....	CKE
			Jan 12, 07	.....	.....	15.4	31 05 N	.....	.....	..	20.2	CKE
			Jan 13, 07	.....	.....	10.8, 15.6	31 06 N	.....	.....	..	20.2	CKE
			Aug 6, 07	.....	.....	.....	.....	15.9(wt.½)	.37059	24	.....	CKE
			Aug 7, 07	.....	.....	.....	.....	11.6, 16.8	.37058	24	.....	CKE
			Aug 12, 07	.....	.....	.....	.....	16.3, 18.8	.37057	2	.....	CKE
			Aug 13, 07	.....	.....	.....	.....	12.2(wt.½)	.37068	24	.....	CKE
			Aug 14, 07	.....	.....	.....	.....	16.9(wt.½)	.37091	2	.....	CKE
			Aug 15, 07	.....	.....	.....	.....	9.9(wt.½)	.37072	2	.....	CKE
			Dec 23, 08	.....	.....	12.3	30 52.0 N	.....	.....	..	171.(567)	DCS
			Dec 24, 08	.....	.....	15.2	30 51.9 N	.....	.....	..	171.(567)	DCS
Hongkong Obs'y, Tent ...	22 19.2 N	114 10	Dec 21, 08	10.1, 16.3	0 03.9 E	.....	.....	12.4, 15.2	.37177	10	.....	DCS
			Dec 22, 08	.....	.....	12.4, 15.4	30 48 N	.....	.....	..	171.(567)	DCS
			Dec 23, 08	9.3	0 04.2 E	.....	.....	.....	.....	10	.....	DCS
Yangkiang.....	21 51.7 N	112 04	Feb 11, 07	10.6, 13.8	0 01.6 W	15.2	29 57 N	11.5, 13.1	.37528	24	20.2	CKE
			Feb 12, 07	14.4, 15.4	0 04.0 W	.....	.....	15.0	.37531	24	.....	CKE
			Feb 13, 07	.....	.....	7.8	29 56 N	.....	.....	..	20.2	CKE
Kochow.....	21 49 N	110 33	Feb 23, 07	9.4, 11.9, 13.6	0 00.1 W	14.5	30 06 N	9.9, 11.4	.37587	24	20.2	CKE
			Feb 25, 07	.....	.....	11.5	30 04 N	.....	.....	..	20.2	CKE
Hua (Fachow).....	21 39 N	110 21	Feb 26, 07	.....	.....	.....	.....	13.3	.37490	24	.....	CKE
Kwan-chau-wan.....	21 08 N	110 24	Jan 20, 06	.....	.....	17.3	28 39.7 N	16.0	.37676	55	71.8	CKE
Cape Kami.....	20 13.1 N	109 52	Jan 31, 06	.....	.....	16.1	26 24.6 N	.....	.....	..	71.78	CKE
			Feb 1, 06	11.4, 14.4	0 38.2 E	.....	.....	13.6	.38140	55	.....	CKE
Hoihow.....	20 01.0 N	110 14	Jan 24, 06	10.7, 17.0	0 35.4 E	.....	.....	12.4, 15.8	.38182	55	.....	CKE
			Jan 25, 06	10.8 to 15.2 (d.v.)	0 33.3 E	16.6	26 05.8 N	.....	.....	55	71.8	CKE
			Jan 26, 06	9.8, 10.3, 14.0	0 36.7 E	15.5	26 10.4 N	11.8, 13.1	.38194	55	71.8	CKE
			Jan 27, 06	.....	.....	9.9	26 08.7 N	.....	.....	..	71.78	CKE
Hiongpo.....	19 43.7 N	109 10	Feb 2, 06	.....	.....	17.8	25 41.4 N	.....	.....	..	71.8	CKE
			Feb 3, 06	10.9, 13.0, 16.8	0 46.1 E	.....	.....	14.5, 15.9	.38330	55	.....	CKE
Kachek.....	19 15.0 N	110 24	Feb 15, 06	11.3	0 41.6 E	15.4	24 46.2 N	11.8	.38337	55	71.8	CKE
Leong Sui Bay.....	18 24 N	109 59	Feb 9, 06	14.6, 16.3	0 40.4 E	11.6	23 04.6 N	15.3, 15.8	.38442	55	71.78	CKE
Yaichow.....	18 18.4 N	109 10	Feb 6, 06	13.9, 15.7	0 50.4 E	17.6	22 32.2 N	14.4, 15.3	.38464	55	71.8	CKE
Yalinkan.....	18 10.8 N	109 30	Feb 7, 06	13.7, 15.7	0 54.8 E	17.8	22 28.0 N	14.4, 14.8	.38537	55	71.8	CKE

CYPRUS.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Larnaca.....	34 53.7 N	33 43	May 25,'10	8.8, 10.7	1 22.6 W	14.2	48 11.7 N	9.3, 10.2	.28467	7	202.1256	WHS

INDIA.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Kizil Langar.....	35 12 N	78 02	Sep 20,'09	6.3	4 01.0 E	6.7	50 51.3 N	7.9	*.3069*	*171*	171.(567)	DCS
Panamik.....	34 47 N	77 30	Sep 25, 09	16.4, 17.6	3 54.8 E	16.8	50 09.4 N	17.2	*.3090*	*171*	171.(56)	DCS
			Sep 26, 09	7.5	3 54.5 E	.....	.....	.....	.....	*171*	.....	DCS
Mulbec.....	34 23 N	76 21	Oct 3, 09	7.4, 8.6	3 51.4 E	7.8	49 30.4 N	8.3	*.3143*	*171*	171.(567)	DCS
Sonamarg.....	34 19 N	75 19	Oct 6, 09	16.9	3 56.2 E	17.1	49 29.8 N	17.4	*.3097*	*171*	171.(56)	DCS
Leh.....	34 10.9 N	77 34	Sep 29, 09	10.5, 11.3	3 32.6 E	12.7	49 24.0 N	10.9	.31322	10	171.(567)	DCS
Srinagar.....	34 04 N	74 49	Oct 9, 09	7.1, 8.2	3 54.5 E	15.4	49 18.1 N	7.4, 7.9	.31020	10	171.(567)	DCS
Dehra Dun Observatory, North House.....	30 19 N	78 03	Oct 19, 09	.....	.....	15.2, 16.0	43 58.8 N	.....	.....	..	171.(567)	DCS
			Oct 21, 09	14.6, 16.0	2 34.4 E	.....	.....	15.2	.33269	10	.....	DCS
			Oct 22, 09	7.2 to 12.7(4)	2 34.6 E	15.2, 16.1	43 53.4 N	8.4, 11.8	.33260	10	171.(567)	DCS

ASIA.

INDIA—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
Dehra Dun Observatory, South House	° ′ 30 19 N	° ′ 78 03	Oct 20,'09	h h h 16.3	° ′ 2 36.3 E	h h 7.8, 8.6	° ′ 43 53.0 N	h h 15.5	Γ .33232	10	171.(567)	DCS
			Oct 21, 09	12.7, 13.0	2 32.2 E	.....	.....	8.2, 12.0	.33271	10	.....	DCS
			Oct 23, 09	10.9, 12.4	2 35.6 E	7.6, 8.4	43 53.2 N	11.5	.33228	10	171.(567)	DCS
Gwadur	25 07.1 N	62 16	Feb 8, 09	9.9	1 52.6 E	15.0	34 36.9 N	10.7, 11.5	.34068	5	177.1256	JCP
			Feb 9, 09	7.0 to 18.0(d.v.)	1 52.5 E	.....	.....	.....	.....	5	.....	JCP

JAPAN.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Tokio	35 42 N	139 46	Aug 15,'06	16.4, 17.9	4 42.8 W	.....	.....	16.9, 17.5	.30056	36	.....	G II
			Aug 16, 06	9.7, 11.2	4 45.0 W	12.6	48 52.1 N	10.1, 10.9	.30044	36	178.1256	G II
			Sep 3, 06	14.1, 16.0	4 42.9 W	.....	.....	14.7, 15.6	.30068	36	.....	G II
Tokio, Secondary	35 42 N	139 46	Aug 15, 06	.....	.....	16.8	48 50.2 N	.....	.....	..	35.25 *	G II
			Aug 16, 06	.....	.....	10.2, 11.8	48 52.4 N	.....	.....	..	35.25	G II
Kisarazu	35 23 N	139 55	Aug 19, 06	9.0, 10.3	4 41.4 W	.....	.....	9.4, 10.0	.30085	36	.....	G II
Kisarazu, Secondary	35 23 N	139 55	Aug 19, 06	.....	.....	9.4	48 26.9 N	.....	.....	..	178.1256	G II
Sugita	35 22.7 N	139 38	Aug 20, 06	11.4, 12.6	4 55.3 W	.....	.....	11.7, 12.2	.30106	36	.....	G II
Sugita, Secondary	35 22.7 N	139 38	Aug 20, 06	.....	.....	11.7	48 31.6 N	.....	.....	..	178.56	G II

PERSIA.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Khoi	38 32.7 N	44 59	Jul 2,'08	10.6, 12.4	2 08.0 E	8.2	52 46.6 N	11.2, 12.0	.26844	5	177.1256	JCP
Tabriz 1	38 04.1 N	46 18	Jul 13, 08	9.8, 11.4	2 21.0 E	18.8	52 02.7 N	10.2, 10.9	.27122	5	177.1256	JCP
Tabriz 2	38 04.1 N	46 18	Jul 14, 08	9.3, 10.9	2 22.6 E	10.1	52 02.0 N	.....	.....	*177*	177.12	JCP
Tabriz 3	38 04.1 N	46 18	Jul 18, 08	5.6, 7.0	2 25.7 E	6.3	52 01.7 N	6.3	*.27156*	*177*	177.12	JCP
Tabriz, 3A	38 04.1 N	46 18	Jul 29, 08	6.5 to 19.0 (d.v.)	2 20.2 E	.....	.....	.....	.....	5	.....	JCP
Binab	37 20.1 N	46 05	Aug 20, 08	17.4	2 33.5 E	18.1	51 21.2 N	18.2	*.27522*	*177*	177.12	JCP
Zenjan	36 39.9 N	48 30	Sep 29, 08	13.4, 15.1	3 07.8 E	10.1	50 30.0 N	13.9, 14.7	.28366	5	177.1256	JCP
Dikantepe	36 24.0 N	47 06	Aug 28, 08	9.3, 11.2	2 32.6 E	10.3	50 04.3 N	10.3	*.28096*	*177*	177.1256	JCP
Kazvin	36 14.6 N	49 59	Oct 3, 08	8.9, 11.0	2 52.4 E	14.4	50 35.4 N	9.8, 10.5	.28177	5	177.1256	JCP
Zergendeh	35 46.5 N	51 26	Oct 12, 08	9.9	3 07.8 E	14.2	49 34.3 N	10.4, 11.1	.28654	5	177.1256	JCP
Teheran	35 40.2 N	51 22	Oct 14, 08	9.6, 11.2	3 09.4 E	14.3	49 31.5 N	10.0, 10.8	.28474	5	177.1256	JCP
Hamadan	34 47.3 N	48 21	Sep 21, 08	14.6, 16.5	2 22.0 E	10.4	48 06.5 N	15.3, 16.2	.28958	5	177.1256	JCP
Hamadan, Secondary	34 47.3 N	48 21	Sep 18 08	14.9, 16.5	2 20.2 E	15.7	48 08.1 N	15.7	*.28936*	*177*	177.12	JCP
Kermanshah	34 18.5 N	47 02	Sep 10, 08	14.2, 15.9	2 04.6 E	10.3	47 22.5 N	14.6, 15.5	.29080	5	177.1256	JCP
Kashan	33 59.4 N	51 28	Oct 24, 08	.....	.....	16.1	47 32.2 N	.....	.....	..	177.1256	JCP
			Oct 25, 08	9.8 to 14.7(6)	2 43.0 E	.....	.....	10.2, 11.2	.29386	5	.....	JCP
Ispahan	32 39.3 N	51 41	Oct 31, 08	9.5, 11.2	2 39.2 E	14.1	45 26.0 N	10.0, 10.8	.30171	5	177.1256	JCP
Ispahan, Secondary	32 39.3 N	51 41	Nov 1, 08	.....	.....	13.5	45 17.2 N	.....	.....	..	177.56	JCP
Shushter, A	32 01.8 N	48 55	Apr 15, 09	9.2	2 02.8 E	11.0	44 20.9 N	9.6	.30266	5	177.12	JCP
Shushter, B	32 01.8 N	48 55	Apr 15, 09	13.7	1 56.9 E	15.5	44 22.4 N	14.4	.30262	5	177.12	JCP
Yezd	31 53.1 N	54 24	Dec 1, 08	.....	.....	13.8	44 33.8 N	.....	.....	..	177.1256	JCP
			Dec 2, 08	8.8, 10.8	2 45.4 E	.....	.....	9.2, 10.4	.30660	5	.....	JCP
Ahwaz	31 19.0 N	48 44	Apr 18, 09	7.2	1 55.0 E	11.0	43 12.2 N	7.6	.30570	5	177.12	JCP
Dehbid	30 37.3 N	53 12	Nov 23, 08	10.4	2 28.5 E	14.1	42 35.0 N	11.0	.31138	5	177.12	JCP
Mohammera, A	30 25.5 N	48 08	Apr 3, 09	17.3	1 38.2 E	18.6	41 53.6 N	17.6	.30923	5	177.12	JCP
Mohammera, B	30 25.5 N	48 08	Apr 3, 09	8.0	1 41.7 E	10.3	41 50.4 N	8.4	.30935	5	177.12	JCP
Mohammera, C	30 25.5 N	48 08	Apr 6, 09	6.4 to 18.2 (d.v.)	1 37.3 E	.....	.....	.....	.....	5	.....	JCP
Kerman	30 17.7 N	57 07	Dec 15, 08	.....	.....	15.2	42 22.5 N	.....	.....	..	177.1256	JCP
			Dec 16, 08	10.3, 11.9	2 48.3 E	.....	.....	10.8, 11.6	.31597	5	.....	JCP
Kerman, Secondary	30 17.7 N	57 07	Dec 17, 08	14.3	2 46.7 E	15.0	42 22.2 N	15.0	*.31607*	*177*	177.12	JCP
Shiraz	29 37.4 N	52 33	Nov 13, 08	8.8, 13.6	2 11.2 E	11.2	41 01.1 N	9.1, 13.2	.31524	5	177.1256	JCP
Bam	29 05.7 N	58 22	Jan 1, 09	.....	.....	11.2	40 33.4 N	.....	.....	..	177.1256	JCP
			Jan 2, 09	9.0, 11.0	2 42.6 E	.....	.....	9.5, 10.5	.32162	5	.....	JCP
Bushire, A	28 59 N	50 49	Mar 20, 09	10.6	1 48.1 E	9.6	39 54.6 N	11.0	.31697	5	177.12	JCP
Bushire, B	28 59 N	50 49	Mar 20, 09	15.6	1 50.9 E	17.3	39 55.4 N	16.0	.31694	5	177.12	JCP
Reshire	28 54.4 N	50 50	Mar 17, 09	9.4, 11.2	1 48.4 E	14.7	39 44.7 N	10.2, 10.9	.31823	5	177.1256	JCP
Reshire, Secondary	28 54.4 N	50 50	Mar 18, 09	9.3	1 49.4 E	11.2	39 43.7 N	9.8	.31770	5	177.12	JCP
Bampur	27 11.2 N	60 23	Jan 20, 09	9.5, 11.5	2 14.2 E	15.0	38 09.4 N	10.1, 11.1	.33037	5	177.1256	JCP
Linga	26 32.7 N	54 54	Mar 2, 09	.....	.....	15.0	36 25.5 N	.....	.....	..	177.1256	JCP
			Mar 3, 09	9.5, 11.4	1 50.0 E	.....	.....	10.0, 10.8	.33002	5	.....	JCP
Jask	25 38.3 N	57 46	Feb 24, 09	14.1, 15.9	1 54.5 E	11.1	35 00.3 N	14.8, 15.6	.33471	5	177.1256	JCP
Jask, Secondary	25 38.3 N	57 46	Feb 25, 09	8.8	1 54.8 E	14.6	35 02.8 N	9.2	.33479	5	177.12	JCP

ASIA.

TURKISH EMPIRE.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	γ			
Ineboli, A	41 58.8 N	33 46	Nov 18,'09	9.7	0 34.5 W	11.2	56 17.2 N	10.3	.24812	5	177.12	JCP
Ineboli, B	41 58.8 N	33 46	Nov 18, 09	12.6	0 38.5 W	13.3	56 15.7 N	.....	.....	177	177.12	JCP
Samsun	41 16.6 N	36 20	Nov 14, 09	12.7, 14.4	0 33.3 E	10.8	55 31.4 N	13.2, 14.0	.25278	5	177.1256	JCP
Samsun, Secondary	41 16 6 N	36 20	Nov 15, 09	9.8	0 35.3 E	11.5	55 35.0 N	10.3	.25254	5	177.12	JCP
Trebizond, Third	41 00 N	39 43	Nov 8, 09	14.1	1 31.7 E	16.4	55 27.0 N	14.5	.25588	5	177.12	JCP
Trebizond	40 59.7 N	39 43	Nov 5, 09	12.4, 14.2	1 30.0 E	15.4	55 46.5 N	13.0, 13.8	.25329	5	177.12	JCP
Trebizond, Secondary	40 59.7 N	39 43	Nov 7, 09	10.6	1 22.5 E	12.2	55 38.3 N	11.0	.25376	5	177.12	JCP
Adabazar	40 45.8 N	30 27	Jul 12, 10	9.2, 11.2	2 00.3 W	14.0	55 06.7 N	9.7, 10.8	.24998	7	202.1256	WHS
Dardanelles	40 06.6 N	26 29	Jul 18, 10	9.9, 11.6	3 09.6 W	14.8	54 12.9 N	10.4, 11.2	.25272	7	202.1256	WHS
Angora	39 56.6 N	32 48	Aug 21, 10	8.9, 10.6	1 07.8 W	14.1	54 06.0 N	9.3, 10.2	.25493	7	202.1256	WHS
Erzerum	39 55.6 N	41 06	Oct 5, 10	9.6, 11.4	1 45.8 E	14.6	54 28.5 N	10.1, 11.0	.25845	7	202.1256	WHS
Mamakhatun	39 48 N	40 10	Oct 1, 10	16.2, 17.1	1 18.0 E	18.1	54 07.4 N	16.6	.26010	7	202.1	WHS
Eskishehr	39 47.2 N	30 34	Jul 10, 10	13.6, 15.6	2 04.3 W	16.7	53 53.7 N	14.1, 15.1	.25523	7	202.12	WHS
Sivas	39 46.1 N	36 54	Sep 6, 10	9.3, 11.1	0 18.6 E	14.1	53 47.9 N	9.8, 10.6	.25846	7	202.1256	WHS
Madrak	39 45.4 N	41 12	Oct 9, 10	9.2, 10.9	0 55.2 E	13.9	53 25.4 N	9.7, 10.5	.26490	7	202.1256	WHS
Erzingan	39 43.2 N	39 14	Sep 28, 10	9.4, 11.1	1 20.4 E	14.2	53 42.4 N	9.8, 10.7	.26164	7	202.1256	WHS
Sazelar	39 39.6 N	31 52	Aug 18, 10	8.8, 10.6	2 00.9 W	14.1	54 06.1 N	9.2, 10.2	.25380	7	202.1256	WHS
Gemakh	39 36.4 N	38 48	Sep 25, 10	13.3, 14.9	0 37.7 E	16.9	53 40.3 N	13.7, 14.5	.26252	7	202.12	WHS
Egin	39 16.1 N	38 16	Sep 21, 10	9.5, 11.5	0 45.8 E	14.2	53 09.4 N	10.0, 11.0	.26254	7	202.12	WHS
Kirs	39 08.9 N	41 23	Oct 14, 10	9.7, 11.4	1 27.4 E	14.7	53 29.4 N	10.2, 11.0	.26185	7	202.1256	WHS
Kirshehr	39 08.2 N	34 06	Aug 25, 10	9.0, 10.9	0 40.8 W	14.2	53 02.5 N	9.4, 10.4	.26038	7	202.1256	WHS
Afiumkarahissar	38 46.2 N	30 36	Jul 1, 10	8.6, 10.6	2 11.2 W	14.1	52 44.6 N	9.3, 10.2	.26054	7	202.1256	WHS
Kaisariyeh	38 43.5 N	35 26	Aug 29, 10	8.6, 8.8, 10.6	0 24.3 W	14.7	52 33.2 N	9.3, 10.2	.26234	7	202.1256	WHS
			Aug 31, 10	11.4, 11.6	0 28.1 W	.....	.....	.....	.....	7	.....	WHS
Kharput	38 40.2 N	39 02	Sep 16, 10	9.3, 11.1	1 02.2 E	14.9	52 51.3 N	9.7, 10.6	.26562	7	202.1256	WHS
Ushak	38 39.9 N	29 25	Jun 29, 10	8.4, 10.4	2 42.6 W	14.1	52 41.3 N	9.0, 10.0	.26000	7	202.1256	WHS
Smyrna	38 27.6 N	27 08	Jun 17, 10	9.4, 11.3	3 38.0 W	14.2	52 08.7 N	9.9, 10.8	.26898	7	202.1256	WHS
Bitlis	38 25.9 N	41 59	Oct 23, 10	9.6, 11.3	2 36.4 E	15.0	52 48.4 N	10.1, 11.0	.26707	7	202.1256	WHS
Tchaouchdjikeuy	38 22.7 N	31 52	Jul 3, 10	8.9, 10.8	1 40.4 W	13.6	52 15.4 N	9.4, 10.4	.26287	7	202.12	WHS
Alashehr	38 21.7 N	28 31	Jun 27, 10	.....	.....	16.5	52 21.2 N	.....	.....	..	202.12	WHS
			Jun 28, 10	8.6, 10.8	2 53.4 W	.....	.....	9.4, 10.3	.26070	7	.....	WHS
Malatia	38 21.3 N	38 10	Sep 12, 10	9.2, 11.2	0 38.1 E	14.0	52 13.2 N	9.7, 10.7	.26684	7	202.1256	WHS
Sert	37 56.1 N	41 48	Oct 27, 10	9.4, 12.4	1 34.4 E	14.2	51 50.8 N	10.1, 11.0	.27072	7	202.12	WHS
Diarbekir	37 54.7 N	40 12	Nov 13, 10	8.9, 10.8	1 20.3 E	14.1	51 52.4 N	9.5, 10.4	.26594	7	202.1256	WHS
Konia	37 53.1 N	32 30	Jul 5, 10	9.2, 11.2	1 29.8 W	14.3	51 35.7 N	9.8, 10.8	.26506	7	202.1256	WHS
Aidin	37 50.8 N	27 50	Jun 22, 10	8.6, 10.5	3 12.6 W	14.1	51 46.5 N	9.2, 10.1	.26270	7	202.1256	WHS
Denizli	37 48.6 N	29 05	Jun 24, 10	8.6, 10.8	2 43.0 W	14.2	51 38.9 N	9.3, 10.7	.26363	7	202.1256	WHS
Marash	37 35.6 N	37 07	May 11, 10	9.5, 10.4	0 06.2 W	14.0	51 04.9 N	10.0, 10.9	.27025	7	202.1256	WHS
Eregli	37 30.3 N	34 06	Jul 6, 10	.....	.....	16.2	51 19.9 N	.....	.....	..	202.12	WHS
			Jul 7, 10	9.0, 10.8	0 58.6 W	.....	.....	9.5, 10.4	.26872	7	.....	WHS
Jezireh-ibn-Omar	37 20.2 N	42 04	Nov 1, 10	9.4, 11.0	1 34.8 E	13.8	51 12.2 N	9.8, 10.7	.27250	7	202.12	WHS
Nisibin	37 04.8 N	41 09	Nov 5, 10	13.0, 14.8	1 06.4 E	.....	.....	13.5, 14.4	.27376	7	.....	WHS
			Nov 6, 10	.....	.....	10.4	50 50.8 N	.....	.....	..	202.1256	WHS
Osmanie	37 04.3 N	36 24	May 15, 10	8.9, 10.8	0 35.7 W	13.9	50 35.1 N	9.4, 10.4	.27142	7	202.1256	WHS
Aintab	37 03.5 N	37 37	May 5, 10	8.8, 10.8	0 01.8 W	13.8	50 31.2 N	9.4, 10.4	.27192	7	202.12	WHS
			May 5, 10	15.1, 16.2	0 04.4 W	.....	.....	15.6	.27206	7	.....	WHS
Birejik	37 01.9 N	38 14	May 3, 10	8.7, 10.6	0 11.2 E	14.1	50 32.6 N	9.2, 10.2	.27257	7	202.1256	WHS
Adana	36 59.8 N	35 24	May 20, 10	9.5, 11.2	0 29.2 W	14.5	50 39.9 N	10.0, 10.8	.27102	7	202.1256	WHS
Mersina	36 46.7 N	34 43	May 22, 10	8.4, 10.3	0 51.0 W	14.0	50 19.8 N	8.9, 9.8	.27135	7	202.1256	WHS
Alexandretta	36 35.5 N	36 14	May 31, 10	9.7, 11.5	0 41.0 W	13.8	50 00.4 N	10.2, 11.1	.27348	7	202.1256	WHS
Rhodes	36 27.2 N	28 12	Jun 12, 10	.....	.....	15.0	50 04.0 N	.....	.....	..	202.1256	WHS
			Jun 13, 10	8.8, 10.8	3 05.0 W	.....	.....	9.4, 10.3	.26939	7	.....	WHS
Mosul	36 20.3 N	43 10	Dec 3, 10	.....	.....	13.6	49 55.2 N	.....	.....	..	202.1256	WHS
			Dec 4, 10	9.0, 10.9	1 42.2 E	.....	.....	9.5, 10.5	.27894	7	.....	WHS
Aleppo	36 13.3 N	37 19	Apr 23, 10	8.6, 10.5	0 12.4 W	13.9	49 38.9 N	9.2, 10.1	.27506	7	202.1256	WHS
			Apr 27, 10	8.7, 10.3, 12.1	0 13.5 W	.....	.....	10.8, 11.6	.27482	7	.....	WHS
Latakia	35 32.4 N	35 49	Jun 2, 10	9.2, 11.0	0 52.8 W	14.1	48 38.4 N	9.7, 10 6	.27859	7	202.1256	WHS
Ummerdjim	35 31.4 N	37 07	Apr 20, 10	.....	.....	15.8	47 51.2 N	.....	.....	..	202.12	WHS
			Apr 21, 10	9.4, 11.3	0 28.9 W	.....	.....	9.9, 10.8	.27925	7	.....	WHS
Kaleh Shergat	35 27.8 N	43 14	Dec 9, 10	.....	.....	13.9	48 48.0 N	.....	.....	..	202.12	WHS
			Dec 10, 10	9.6, 11.6	1 30.2 E	.....	.....	10.3, 11.2	.28306	7	.....	WHS
Homs	34 43.9 N	36 51	Apr 19, 10	9.1, 10.9	0 03.9 W	14.3	47 45.6 N	9.7, 10.5	.28396	7	202.12	WHS
Tekrit	34 36.2 N	43 42	Dec 13, 10	9.3, 11.0	1 30.8 E	16.6	47 42.8 N	9.7, 10.6	.28714	7	202.1256	WHS
Tadmor	34 32.8 N	38 24	Apr 13, 10	9.0, 10.8	0 16.6 W	14.3	47 23.3 N	9.5, 10.3	.28418	7	202.1256	WHS
Ain el Bieda	34 30.3 N	38 05	Apr 15, 10	12.8, 14.7	0 12.1 W	16.5	47 24.6 N	13.4, 14.3	.28466	7	202.12	WHS
Karietein	34 13.1 N	37 25	Apr 10, 10	8.2, 10.2, 10.6	0 20.5 W	13.7	46 58.5 N	8.8, 9.8	.28468	7	202.12	WHS
Nebk	34 01 N	36 54	Apr 8, 10	13.6, 14.7	0 32.9 W	16.9	46 45.4 N	14.0	.28455	7	202.12	WHS

ASIA.

TURKISH EMPIRE—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Beirut	33 54.4 N	35 30	Mar 6,'10	9.6, 11.5, 11.8	1 13.4 W	15.7	46 35.1 N	10.1, 11.0	.28610	7	202.1256	WHS
			Jun 7, 10	9.1, 11.0, 11.3	1 11.6 W	.....	.....	9.6, 10.5	.28592	7	.....	WHS
Kuteifeh	33 47 N	36 46	Apr 7, 10	14.1, 15.2	0 35.7 W	17.2	46 30.1 N	14.6	.28728	7	202.12	WHS
Damascus	33 30.4 N	36 19	Feb 28, 10	9.7, 11.4	0 45.7 W	14.3	45 55.8 N	10.2, 11.0	.28801	7	202.1256	WHS
			Apr 3, 10	10.2, 12.0	0 44.8 W	.....	.....	10.7, 11.5	.28812	7	.....	WHS
Ramadieh	33 26.1 N	43 18	Dec 31, 10	.....	.....	13.9	46 08.0 N	.....	.....	..	202.1256	WHS
			Jan 1, 11	10.1, 11.9	1 00.4 E	.....	.....	10.6, 11.6	.29224	7	.....	WHS
Bagdad	33 19.9 N	44 26	Dec 21, 10	10.0, 11.8	1 24.1 E	14.0	46 00.2 N	10.4, 11.4	.29340	7	202.1256	WHS
Haifa	32 50.3 N	34 57	Feb 22, 10	10.0, 11.7	1 30.1 W	14.4	45 16.3 N	10.5, 11.3	.29040	7	202.1256	WHS
Dera'a	32 37.9 N	36 05	Feb 24, 10	.....	.....	15.4	44 34.6 N	.....	.....	..	202.12	WHS
			Feb 25, 10	9.9, 11.7	1 07.6 W	.....	.....	10.4, 11.3	.29210	7	.....	WHS
Jaffa	32 03.9 N	34 47	Feb 9, 10	9.6, 11.7	1 20.1 W	14.4	44 04.4 N	10.1, 11.1	.29372	7	202.1256	WHS
Jericho	31 51.4 N	35 25	Feb 15, 10	13.0, 14.9	1 35.6 W	16.6	43 33.7 N	13.5, 14.4	.29538	7	202.12	WHS
Jerusalem	31 47.9 N	35 13	Feb 12, 10	9.6, 11.3	1 34.8 W	14.7	43 27.9 N	10.1, 10.9	.29548	7	202.1256	WHS
Katrane	31 14.6 N	36 10	Apr 1, 10	9.6, 11.5	1 14.2 W	14.5	42 40.4 N	10.2, 11.1	.29810	7	202.1256	WHS
Basra	30 31.7 N	47 49	Apr 26, 09	11.1, 12.6	1 31.0 E	8.1	42 02.0 N	11.5, 12.1	.30829	5	177.1256	JCP
Basra, Secondary	30 31.7 N	47 49	Apr 27, 09	10.6	1 33.8 E	12.0	41 58.5 N	10.9	.30824	5	177.12	JCP
Ma'an	30 11.4 N	35 54	Mar 29, 10	8.6, 10.3, 10.6	1 38.6 W	14.1	41 22.4 N	9.1, 9.9	.30108	7	202.1256	WHS
Koweit	29 22.1 N	47 59	Mar 26, 09	9.6, 11.5	1 19.7 E	14.0	40 10.8 N	10.2, 11.0	.31431	5	177.1256	JCP
Koweit, Secondary	29 22.1 N	47 59	Mar 27, 09	10.4	1 21.0 E	11.6	40 09.8 N	10.7	.31422	5	177.12	JCP
Tebook	28 23.1 N	36 41	Mar 20, 10	8.8, 10.5	1 32.6 W	14.1	38 09.3 N	9.3, 10.0	.31184	7	202.1256	WHS
			Mar 26, 10	.....	.....	13.2	38 03.2 N	.....	.....	..	202.1256	WHS
Madain Saleh	26 48.6 N	38 02	Mar 17, 10	9.8, 12.9	1 08.0 W	14.9	35 28.2 N	10.5, 11.4	.31746	7	202.1256	WHS
			Mar 17, 10	17.0, 18.1	1 06.4 W	.....	.....	17.5	.31697	7	.....	WHS
Bahrein Island	26 13.6 N	50 34	Mar 8, 09	.....	.....	15.0	35 13.1 N	.....	.....	..	177.1256	JCP
			Mar 9, 09	10.1, 11.7	1 24.1 E	.....	.....	10.6, 11.3	.32848	5	.....	JCP
Bahrein Island, Secondary	26 13.6 N	50 34	Mar 11, 09	9.1	1 25.5 E	10.8	35 11.8 N	9.5	.32836	5	177.12	JCP
Sheikh Othman	12 52.0 N	45 00	Mar 19, 09	9.1, 10.4	1 05.8 W	7.7	6 44.9 N	9.5, 10.1	.35346	5	177.1256	JCP
Sheikh Othman, Secondary	12 52.0 N	45 00	Mar 18, 09	9.2	1 05.8 W	11.0	6 39.2 N	9.6	.35438	5	177.12	JCP
Aden*	12 47.2 N	44 59	May 14, 09	6.7, 8.2	1 17.4 W	10.6	6 44.6 N	7.2, 7.9	.35545	5	177.1256	JCP
Aden, North*	12 47.2 N	44 59	May 15, 09	6.7	1 10.1 W	8.4	6 48.8 N	7.1	.35410	5	177.12	JCP

*Local disturbance.

AUSTRALASIA.

AUSTRALIA.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Red Hill	33 44.6 S	151 04	Nov 25,'06	13.7, 15.7	9 28.8 E	16.5	63 04.8 S	13.4	.26309	2025	171.(56)	GH
Melbourne, North Pier, Observatory	37 49.9 S	144 58	Nov 20, 06	11.8	8 10.7 E	.....	.....	15.5	.23162	2025	.....	GH
			Nov 22, 06	9.3	8 06.2 E	.....	.....	10.8	.23121	2025	.....	GH
			Nov 23, 06	7.5, 14.2	8 14.4 E	.....	.....	.....	.....	2025	.....	GH
			Nov 24, 06	8.0	8 08.7 E	.....	.....	8.7	.23145	2025	.....	GH
Melbourne, South Pier, Observatory	37 49.9 S	144 58	Nov 20, 06	.....	.....	8.0	67 35.4 S	9.7	*.23195*	*171*	171.(56)	GH
			Nov 23, 06	.....	.....	11.0	67 37.2 S	15.1	*.23187*	*171*	171.(56)	GH
			Nov 24, 06	.....	.....	10.4	67 37.2 S	.....	.....	...	171.(56)	GH

NEW ZEALAND.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Auckland	36 51.7 S	174 46	Nov 8,'06	11.7, 15.9	15 23.6 E	10.7	61 41.0 S	14.5	.26426	2025	171.(56)	GH
Christchurch, Absolute Magnetic Observatory	43 31.8 S	172 37	Jul 9, 06	11.3, 12.4, 14.4	16 28.9 E	.....	.....	.....	.....	2025	.....	GH
			Jul 10, 06	.....	.....	9.8, 11.9	67 48.0 S	.....	.....	....	171.12	GH
			Jul 10, 06	.....	.....	15.3	67 50.0 S	.....	.....	....	171.12	GH
			Jul 13, 06	.....	.....	.....	.....	14.2, 16.0	.22596	2025	.....	GH
			Jul 21, 06	10.6	16 28.3 E	.....	.....	11.5	.22618	2025	.....	GH
			Dec 31, 07	15.6, 17.4	16 35.8 E	.....	.....	16.6	.22618	4	.....	G III
			Jan 3, 08	15.3, 17.t	16 36.9 E	.....	.....	16.1	.22624	4	.....	G III
			Jan 6, 08	15.7	16 40.9 E	12.6	67 50.7 S	16.5	.22615	4	178.12	G III
Christchurch, Brass Pipe, Observatory	43 31.8 S	172 37	Dec 30, 07	.....	.....	16.0	67 50.7 S	.....	.....	..	178.12	G III
			Dec 31, 07	11.3, 13.1	16 36.2 E	.....	.....	12.2	.22578	4	.....	G III
			Jan 3, 08	.....	.....	12.4	67 51.9 S	.....	.....	..	189.56	G III
			Jan 4, 08	11.3, 12.9	16 37.6 E	.....	.....	12.0, 15.1	.22615	4	.....	G III
Christchurch, near Brass Pipe, Observatory	43 31.8 S	172 37	Dec 31, 07	.....	.....	10.9, 11.8	67 52.6 S	.....	.....	..	169.12	G III
			Dec 31, 07	.....	.....	15.4, 16.4	67 51.0 S	.....	.....	..	169.12	G III
Christchurch, Peg II, Observatory	43 31.8 S	172 37	Jul 11, 06	.....	.....	10.5, 15.3	67 48.2 S	.....	.....	..	171.12(56)	GH
			Jul 12, 06	.....	.....	10.8, 14.9	67 50.0 S	.....	.....	..	171.(56)	GH
			Jul 16, 06	.....	.....	12.2	67 50.5 S	.....	.....	..	171.12	GII
Christchurch, Peg A, Observatory	43 31.8 S	172 37	Jan 3, 08	.....	.....	15.1, 16.5	67 50.2 S	.....	.....	..	189.56	G III
			Jan 3, 08	.....	.....	17.7	67 52.0 S	.....	.....	..	178.12	G III
New Brighton Beach	43 31.8 S	172 44	Jan 9, 08	11.5, 13.1	16 46.8 E	15.4	67 49.1 S	12.0, 12.7	.22692	4	178.12	G III

EUROPE.

AUSTRIA-HUNGARY.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Pola, Absolute Observatory	44 51.8 N	13 51	Feb 8,'10	8.9, 11.3	8 31.4 W	.....	.....	10.0, 10.8	.22214	5	.....	JCP
			Feb 8, 10	14.2, 16.0	8 31.6 W	.....	.....	14.6, 15.6	.22225	5	.....	JCP
			Feb 9, 10	8.5, 10.3	8 30.7 W	.....	.....	9.0, 9.9	.22218	5	.....	JCP
			Feb 9, 10	14.3, 15.9	8 33.8 W	.....	.....	14.7, 15.5	.22220	5	.....	JCP
			Feb 10, 10	8.4, 10.1	8 32.0 W	16.0	60 03.9 N	8.8, 9.7	.22220	5	177.1256	JCP
			Feb 10, 10	10.5, 11.9	8 33.4 W	.....	.....	10.8, 11.5	.22224	5	.....	JCP
			Feb 11, 10	.....	.....	9.2, 11.2	60 05.0 N	.....	.....	..	177.1256	JCP
			Feb 11, 10	.....	.....	15.0	60 04.8 N	.....	.....	..	177.1256	JCP
			Feb 12, 10	.....	.....	9.2, 11.0	60 03.9 N	.....	.....	..	177.1256	JCP
			Feb 12, 10	.....	.....	14.9	60 04.2 N	.....	.....	..	177.1256	JCP
			Feb 14, 10	8.6, 10.4	8 31.2 W	.....	.....	9.1, 10.0	.22224	5	.....	JCP

GERMANY.

Potsdam Observatory,	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Pier 5	52 23.0 N	13 04	Feb 21,'10	14.6, 16.8	9 06.0 W	.....	.....	15.2, 16.3	.18832	5	.....	JCP
			Feb 22, 10	8.4, 10.4, 10.9	9 05.3 W	.....	.....	8.9, 10.0	.18846	5	.....	JCP
			Feb 22, 10	12.5, 14.6, 16.4	9 08.0 W	.....	.....	11.3, 12.1	.18827	5	.....	JCP
			Feb 22, 10	.....	.....	.....	.....	15.0, 16.0	.18840	5	.....	JCP
			Feb 23, 10	12.1, 14.0	9 08.5 W	.....	.....	12.6, 13.5	.18830	5	.....	JCP
			Feb 24, 10	8.4, 10.1	9 04.3 W	15.9	66 19.0 N	8.8, 9.7	.18854	5	177.1256	JCP
			Feb 24, 10	10.4, 12.1	9 06.8 W	.....	.....	10.8, 11.6	.18838	5	.....	JCP
			Feb 25, 10	.....	.....	9.7	66 20.9 N	.....	.....	..	177.1256	JCP
			Feb 25, 10	.....	.....	15.1, 16.7	66 22.4 N	.....	.....	..	177.1256	JCP
			Feb 28, 10	.....	.....	9.9, 12.1	66 19.7 N	.....	.....	..	177.1256	JCP
			Feb 28, 10	.....	.....	16.2	66 20.2 N	.....	.....	..	177.1256	JCP

GREAT BRITAIN.

Kew, New Absolute	° ′	° ′		h h h	° ′	h h	° ′	h b	Γ			
Observatory	51 28.1 N	359 41	Mar 9,'08	.....	.....	16.2	66 59.5 N	.....	.....	..	177.1256	JCP
			Mar 10, 08	12.4, 15.3	16 22.1 W	.....	.....	13.3, 14.9	.18504	5	.....	JCP
			Mar 10, 08	15.7, 15.9	16 21.2 W	.....	.....	.....	.....	5	.....	JCP
			Mar 11, 08	9.1, 10.9, 12.7	16 20.3 W	16.2	66 58.4 N	9.6, 10.5	.18498	5	177.1256	JCP
			Mar 11, 08	13.1, 14.4	16 24.7 W	.....	.....	11.3, 12.2	.18498	5	.....	JCP
			Mar 12, 08	14.7, 16.5	16 20.3 W	10.9	66 59.2 N	15.1, 16.1	.18506	5	177.1256	JCP
			Mar 13, 08	9.3, 11.0	16 16.5 W	.....	.....	9.7, 10.6	.18490	5	.....	JCP
			Mar 17, 08	13.2, 14.5	16 26.3 W	10.2	67 00.3 N	11.8, 12.8	.18494	5	177.12	JCP
			Mar 17, 08	.....	.....	15.5	66 59.2 N	.....	.....	..	177.1256	JCP
			Jan 18, 10	.....	.....	14.6	66 57.4 N	.....	.....	..	142.1235	JCB
			Jan 19, 10	10.8 to 13.5(8)	16 09.2 W	.....	.....	.....	.....	73	.....	JCB
			Jan 20, 10	10.4 to 12.2(4)	16 08.3 W	14.8	66 57.2 N	.....	.....	73	142.1235	JCB
			Jan 20, 10	.....	.....	15.7	66 57.9 N	.....	.....	..	142.15	JCB
			Jan 21, 10	.....	.....	.....	.....	11.8, 15.1	.18502	73	.....	JCB
			Jan 22, 10	.....	.....	.....	.....	10.4, 12.1	.18488	73	.....	JCB
			Mar 8, 10	9.6, 11.7, 12.1	16 07.0 W	.....	.....	10.2, 11.3	.18493	5	.....	JCP
			Mar 8, 10	14.5, 14.8, 16.7	16 08.3 W	.....	.....	12.6, 14.1	.18504	5	.....	JCP
			Mar 8, 10	.....	.....	.....	.....	15.2, 16.2	.18506	5	.....	JCP
			Mar 9, 10	9.3, 11.1, 12.8	16 08.2 W	16.0	66 58.1 N	9.8, 10.8	.18499	5	177.1256	JCP
			Mar 9, 10	14.3, 14.4	16 09.6 W	.....	.....	11.6, 12.4	.18512	5	.....	JCP
			Mar 10, 10	.....	.....	10.0, 11.9	66 57.8 N	.....	.....	..	177.1256	JCP
			Mar 11, 10	11.3, 14.2, 14.4	16 10.7 W	10.0, 15.7	66 57.4 N	11.8, 12.8	.18502	5	177.1256	JCP
			Mar 12, 10	.....	.....	10.1	66 58.3 N	11.8	.18512	5	177.1256	JCP
Falmouth, Trefusis												
Point, A	50 10 N	354 57	Oct 20, 09	10.0, 11.9	17 47.1 W	14.5	66 34.6 N	10.6, 11.5	.18724	2	178.25	C I
			Oct 21, 09	.....	.....	16.5(wt.½)	66 35.8 N	.....	.....	..	189.9, 10	C I
			Oct 22, 09	13.3, 14.9	17 47.8 W	9.3, 11.1	66 32.7 N	13.7, 14.5	.18756	4	201.12	C I
			Oct 22, 09	.....	.....	16.5(wt.½)	66 33.0 N	.....	.....	..	203.56	C I
Falmouth, Trefusis												
Point, B	50 10 N	354 57	Oct 21, 09	10.6, 14.5	17 45.0 W	16.5	66 32.8 N	12.8, 13.8	.18739	4	201.12	C I
			Oct 22, 09	.....	.....	10.1	66 35.9 N	.....	.....	..	189.9, 10	C I
Falmouth Observatory	50 09.0 N	354 55	Oct 22, 09	10.2, 12.3, 13.6	17 48.7 W	16.5	66 31.0 N	10.7, 11.7	.18767	2	201.12	C I
			Oct 22, 09	.....	.....	.....	.....	14.3, 15.2	.18767	2	.....	C I
			Oct 29, 09	11.1, 14.5	17 48.9 W	10.1, 16.3	66 30.8 N	11.8, 13.8	.18765	4	201.12	C I
St. Anthony	50 08 N	355 00	Oct 25, 09	.....	.....	12.1	66 36.0 N	12.8	*.18745*	*203*	203.56	C I
			Oct 26, 09	11.7, 13.3	17 54.7 W	12.1	66 32.5 N	12.6	*.18741*	*203*	203.56	C I

EUROPE.

EUROPEAN RUSSIA.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Ufa, A	54 42.7 N	55 58	Oct 1,'09	9.8	10 15.2 E	11.4	68 35.9 N	10.2	.19012	5	177.12	JCP
Ufa, B	54 42.7 N	55 58	Oct 1, 09	13.8	10 09.6 E	15.0	68 33.2 N	14.1	.19020	5	177.56	JCP
Samara	53 12.1 N	50 10	Oct 4, 09	9.7	9 05.0 E	14.1	66 35.5 N	10.2, 11.2	.20163	5	177.1256	JCP
Orenburg, A	51 45.1 N	55 06	Sep 27, 09	9.0	8 53.2 E	11.3	66 03.6 N	9.5	.20752	5	177.12	JCP
Orenburg, B	51 45.1 N	55 06	Sep 27, 09	13.6	8 46.3 E	15.1	66 02.2 N	14.0	.20764	5	177.56	JCP
Yenotaevsk	47 14.8 N	47 01	Oct 9, 09	9.4, 11.1	5 01.9 E	13.8	61 53.4 N	9.8, 10.7	.22609	5	177.1256	JCP
Petrovsk	42 59.2 N	47 30	Oct 13, 09	9.4, 10.9	4 12.8 E	13.8	57 29.0 N	9.8, 10.5	.25031	5	177.1256	JCP
Karsani (Tiflis Obs'y), A	41 50 N	44 42	Jun 9, 08	9.5, 11.0	2 43.2 E	16.9	56 24.8 N	9.9, 10.6	.25408	5	177.1256	JCP
			Jun 9, 08	11.5, 15.1	2 39.2 E	.....	.....	11.9, 14.7	.25432	5	.....	JCP
			Jun 10, 08	14.6, 16.1	2 36.7 E	9.4, 11.8	56 26.5 N	15.0, 15.7	.25439	5	177.1256	JCP
			Jun 10, 08	16.6, 18.0	2 38.8 E	.....	.....	17.2, 17.8	.25436	5	.....	JCP
			Jun 11, 08	8.2, 10.0	2 42.6 E	15.4	56 24.5 N	8.6, 9.7	.25404	5	177.1256	JCP
			Jun 11, 08	10.6, 11.8	2 38.8 E	.....	.....	10.9, 11.5	.25417	5	.....	JCP
			Jun 29, 09	10.6, 12.6	2 46.6 E	15.9	56 30.3 N	11.2, 12.2	.25372	5	177.1256	JCP
			Jun 29, 09	17.9, 18.1	2 45.4 E	.....	.....	.....	.....	5	.....	JCP
			Jun 30, 09	9.0, 10.8	2 47.1 E	17.5	56 30.1 N	9.5, 10.4	.25380	5	177.1256	JCP
			Jun 30, 09	11.2, 15.6	2 44.4 E	.....	.....	11.7, 15.2	.25392	5	.....	JCP
			Jul 1, 09	17.6	2 45.6 E	9.0, 11.6	56 30.3 N	17.9	.25402	5	177.1256	JCP
			Jul 2, 09	7.8, 9.4, 9.8	2 47.2 E	.....	.....	8.2, 9.1	.25394	5	.....	JCP
			Jul 2, 09	.....	.....	.....	.....	10.2, 11.0	.25386	5	.....	JCP
Karsani (Tiflis Obs'y), P	41 50 N	44 42	Jun 8, 08	15.5, 17.1	2 36.8 E	18.2	56 27.2 N	15.9, 16.7	.25418	5	177.1256	JCP
			Jul 3, 09	15.8	2 42.9 E	17.7	56 32.8 N	16.3	.25357	5	177.12	JCP
Karsani (Tiflis Obs'y), O	41 50 N	44 42	Jun 28, 09	16.5, 16.7	2 43.8 E	18.8	56 28.8 N	17.2, 18.0	.25400	5	177.12	JCP
Batum	41 39.4 N	41 38	Jun 5, 08	9.6, 11.4	1 41.0 E	14.7	56 16.3 N	10.1, 11.0	.25216	5	177.1256	JCP
			Jun 20, 09	10.3, 12.5	1 44.3 E	14.6	56 16.6 N	11.0, 12.1	.25215	5	177.1256	JCP
Batum, Secondary	41 39.4 N	41 38	Jun 21, 09	9.5	1 45.7 E	11.6	56 17.4 N	10.0	.25213	5	177.12	JCP
Elisavetpol	40 49 N	46 12	Oct 24, 09	12.4, 14.0	3 21.6 E	11.0	55 01.7 N	13.2	.26116	5	177.12	JCP
Alexandropol	40 47.4 N	43 48	Jun 21, 08	9.9, 11.6	2 25.0 E	14.3	55 15.5 N	10.5, 11.2	.25638	5	177.1256	JCP
Alexandropol, Secondary*	40 47.4 N	43 48	Jun 21, 08	.....	.....	16.3	55 03.2 N	16.3	*.25715*	*177*	177.56	JCP
Baku	40 20.7 N	49 49	Oct 16, 09	9.8, 11.2	4 03.2 E	13.9	54 54.5 N	10.2, 10.9	.26350	5	177.1256	JCP
Baku, Secondary	40 20.7 N	49 49	Oct 18, 09	10.1, 11.0	4 04.4 E	13.1	54 53.8 N	10.5	.26331	5	177.12	JCP
Erivan*	40 09.6 N	44 29	Jun 23, 08	9.8, 11.4	3 28.2 E	14.4	55 45.0 N	10.2, 11.1	.26128	5	177.1256	JCP
Erivan, Secondary*	40 09.6 N	44 29	Jun 22, 08	17.4, 18.8	2 04.6 E	18.1	55 14.6 N	18.1	*.25959*	*177*	177.12	JCP
Jevat	40 00 N	48 27	Oct 21, 09	8.9, 10.6	2 59.6 E	12.7	54 50.9 N	9.4, 10.2	.26158	5	177.1256	JCP
Nakhitchevan	39 13.2 N	45 24	Jun 28, 08	6.4, 8.2	2 50.2 E	10.5	53 42.9 N	6.9, 7.7	.26563	5	177.1256	JCP
Nakhitchevan, Secondary	39 13.2 N	45 24	Jun 27, 08	17.6, 19.2	2 49.9 E	18.4	53 43.4 N	18.5	*.26607*	*177*	177.12	JCP

TURKISH EMPIRE.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Adrianople	41 40.9 N	26 38	Jul 24,'10	8.6, 10.6	3 14.0 W	14.0	56 06.0 N	9.1, 10.1	.24394	7	202.1256	WHS
Tcherkeskioi	41 17.3 N	28 05	Jul 21, 10	.....	.....	15.9	55 35.8 N	.....	.....	..	202.12	WHS
			Jul 22, 10	8.5, 10.3	2 38.0 W	.....	.....	9.0, 9.9	.24668	7	.....	WHS
Rumeli Hissar, Hill Station	41 04.9 N	29 05	Jun 10, 09	9.3, 11.1	2 16.8 W	14.4	55 07.9 N	9.8, 10.7	.25023	5	177.1256	JCP
Rumeli Hissar	41 04.8 N	29 05	Apr 8, 08	9.5, 11.4	2 24.5 W	14.4	55 07.1 N	10.1, 11.0	.24960	5	177.12	JCP
			Apr 10, 08	.....	.....	15.2	55 08.0 N	.....	.....	..	177.1256	JCP
			Apr 11, 08	7.4 to 14.4 (d.v.)	2 23.6 W	.....	.....	.....	.....	5	.....	JCP
			Jun 4, 09	9.0, 11.2	2 14.8 W	14.6	55 07.5 N	9.6, 10.8	.24992	5	177.1256	JCP
Rumeli Hissar, Secondary	41 04.8 N	29 05	Apr 9, 08	14.0	2 28.0 W	.....	.....	14.3	.24952	5	.....	JCP
Rumeli Hissar, A	41 04.8 N	29 05	Jan 18, 10	14.5, 16.4	2 10.5 W	.....	.....	15.0, 15.9	.24969	7	.....	WHS
			Jan 19, 10	.....	.....	.....	.....	13.8, 14.8	.24968	7	.....	WHS
			Jan 21, 10	9.9, 11.7	2 09.2 W	.....	.....	10.4, 11.2	.24950	7	.....	WHS
			Jan 21, 10	12.2, 14.4	2 11.2 W	.....	.....	12.6, 13.9	.24968	7	.....	WHS
			Jan 21, 10	14.8, 16.6	2 10.3 W	.....	.....	15.2, 16.1	.24982	7	.....	WHS
			Jan 22, 10	.....	.....	12.0, 15.1	55 13.5 N	.....	.....	..	202.1256	WHS
			Jan 25, 10	.....	.....	10.7	55 15.4 N	.....	.....	..	202.1256	WHS
			Jan 25, 10	.....	.....	13.5, 15.8	55 17.3 N	.....	.....	..	177.1256	JCP
			Jan 26, 10	10.0, 11.7	2 11.2 W	.....	.....	10.4, 11.3	.24958	5	.....	JCP
			Jan 26, 10	12.1, 14.1	2 12.0 W	.....	.....	12.5, 13.6	.24942	5	.....	JCP
			Jan 26, 10	14.5, 16.1	2 11.2 W	.....	.....	14.9, 15.7	.24951	5	.....	JCP
			Jan 27, 10	.....	.....	11.1	55 13.2 N	.....	.....	..	177.1256	JCP
Rumeli Hissar, B	41 04.8 N	29 05	Jan 18, 10	14.5, 16.4	2 10.0 W	.....	.....	15.0, 15.9	.25022	5	.....	JCP
			Jan 19, 10	13.2	2 09.7 W	.....	.....	13.8, 14.9	.24985	5	.....	JCP
			Jan 21, 10	9.9, 11.7	2 08.5 W	.....	.....	10.4, 11.3	.24988	5	.....	JCP
			Jan 21, 10	12.2, 14.3	2 10.3 W	.....	.....	12.6, 13.9	.25000	5	.....	JCP
			Jan 21, 10	14.7, 16.6	2 10.0 W	.....	.....	15.2, 16.1	.25021	5	.....	JCP
			Jan 22, 10	.....	.....	12.0, 15.1	55 11.6 N	.....	.....	..	177.1256	JCP
			Jan 25, 10	.....	.....	10.7	55 14.0 N	.....	.....	..	177.1256	JCP
			Jan 25, 10	.....	.....	13.6, 15.9	55 16.7 N	.....	.....	..	202.1256	WHS
			Jan 26, 10	10.0, 11.7	2 10.4 W	.....	.....	10.4, 11.3	.24984	7	.....	WHS
			Jan 26, 10	12.1, 14.1	2 11.2 W	.....	.....	12.5, 13.7	.24981	7	.....	WHS
			Jan 26, 10	14.5, 16.1	2 10.8 W	.....	.....	14.9, 15.7	.24978	7	.....	WHS
			Jan 27, 10	.....	.....	11.1	55 12.6 N	.....	.....	..	202.1256	WHS

* Local disturbance.

NORTH AMERICA.

CANADA.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Niantilik	64 53.5 N	293 43	Sep 11,'08	14.9, 16.8	60 17.2 W	.....	.....	15.9	.06972	1	.....	CCC
			Sep 12, 08	7.6, 11.1	60 07.2 W	8.4, 10.4	83 39.4 N	9.4	*.06575*	*35*	35.12	CCC
			Sep 12, 08	12.9, 15.0	60 56.6 W	.....	.....	14.0	.06825	1	.....	CCC
International Boundary, A	64 40.8 N	219 00	Aug 27, 07	16.9, 18.8	35 26.2 E	.....	.....	17.9	.12118	1	.....	JCP
			Aug 27, 07	.....	.....	14.9	78 17.1 N	14.9	*.12100*	*35*	35.12	JCP
International Boundary, B	64 40.4 N	219 03	Aug 28, 07	16.4, 17.9	35 34.9 E	.....	.....	17.2	.11877	1	.....	JCP
			Aug 28, 07	.....	.....	14.0	78 31.6 N	14.0	*.11836*	*35*	35.12	JCP
Forty Mile	64 25.0 N	219 24	Aug 26, 07	10.6	34 41.0 E	10.6	78 13.4 N	10.5	*.12049*	*35*	35.12	JCP
			Aug 26, 07	13.2, 15.6	34 44.6 E	.....	.....	14.7	.12115	1	.....	JCP
Craft Island	64 22.9 N	295 02	Sep 10, 08	10.7	59 09.7 W	.....	.....	.....	.....	1	.....	CCC
Dawson	64 03.6 N	220 34	Aug 22, 07	16.0	34 51.2 E	16.0	77 58.4 N	16.1	*.12474*	*35*	35.12	JCP
			Aug 23, 07	9.2, 11.4	35 12.0 E	.....	.....	10.3, 15.2	.12484	1	.....	JCP
			Aug 23, 07	14.3, 16.3	34 57.0 E	.....	.....	.....	.....	1	.....	JCP
			Aug 24, 07	10.8, 13.8	35 04.9 E	.....	.....	.....	.....	1	.....	JCP
			Sep 4, 07	8.8 to 17.2 (d.v.)	34 53.0 E	.....	.....	.....	.....	1	.....	JCP
Cumberland Sound	64 00 N	295 30	Sep 15, 08	17.0	57 30.5 W	15.8	82 56.7 N	16.6	*.07286*	*35*	35.12	CCC
Stewart	63 18.2 N	220 31	Sep 7, 07	10.4	33 52.7 E	10.3	78 01.3 N	10.4	*.12240*	*35*	35.12	JCP
			Sep 7, 07	14.6, 16.4	33 57.9 E	.....	.....	15.5	.12232	1	.....	JCP
Fort Selkirk	62 47.0 N	222 38	Sep 10, 07	9.9, 11.5	33 55.6 E	.....	.....	.....	.....	1	.....	JCP
			Sep 10, 07	14.5	33 38.8 E	14.6	78 40.1 N	14.7	*.11709*	*35*	35.12	JCP
			Sep 11, 07	9.8, 11.4	33 51.4 E	.....	.....	10.6	.11641	1	.....	JCP
Tantalus	62 05.5 N	223 54	Sep 13, 07	9.9, 11.6	34 16.5 E	.....	.....	10.8	.12421	1	.....	JCP
			Sep 13, 07	14.6	34 09.1 E	14.7	77 54.0 N	14.7	*.12424*	*35*	35.12	JCP
Whitehorse	60 41.4 N	224 55	Aug 18, 07	10.3, 12.0	32 14.5 E	.....	.....	11.3	.12692	1	.....	JCP
			Aug 18, 07	14.9	32 46.3 E	15.0	77 38.3 N	15.0	*.12736*	*35*	35.12	JCP
Canoe Limit	60 01.9 N	259 13	Aug 3, 08	7.0, 8.8	21 26.4 E	.....	.....	7.5, 8.3	.06481	7	.....	A&S
			Aug 3, 08	10.0, 11.3	21 16.8 E	10.7	84 10.0 N	10.7	*.06494*	*172*	172.3	A&S
			Aug 3, 08 to Aug 4, 08	13.0 to 12.0 (d. v.)	20 55.2 E	.....	.....	.....	.....	7	.....	A&S
Husky Portage	59 50.3 N	259 05	Jul 31, 08	18.0	15 39.8 E	.....	.....	.....	.....	7	.....	A&S
			Aug 1, 08	16.6, 8.4	16 01.0 E	.....	.....	7.1, 7.9	.06574	7	.....	A&S
			Aug 1, 08	10.1, 11.2	15 45.4 E	10.7	84 00.6 N	10.7	*.06553*	*172*	172.3	A&S
Husky Post	59 20.9 N	258 30	Jul 28, 08	16.6, 17.9	28 01.4 E	17.3	83 55.8 N	17.3	*.06654*	*172*	172.3	A&S
			Jul 29, 08	6.4, 8.4, 10.3	28 23.8 E	.....	.....	9.6, 9.8	.06619	7	.....	A&S
			Aug 7, 08	20.0	27 57.3 E	.....	.....	.....	.....	7	.....	A&S
Jack Fish Lake	58 34.3 N	258 31	Jul 23, 08	20.2	23 25.3 E	.....	.....	.....	.....	7	.....	A&S
			Jul 24, 08	5.8, 7.8	23 42.4 E	.....	.....	6.4, 7.3	.07656	7	.....	A&S
			Jul 24, 08	9.2, 10.3	23 38.0 E	9.8	83 17.5 N	9.8	*.07546*	*172*	172.3	A&S
Lac du Brochet	57 52.7 N	258 23	Jul 14, 08	13.5, 15.8	20 00.3 E	.....	.....	13.9, 15.4	.08164	7	.....	A&S
			Jul 14, 08	16.2, 17.6	20 12.4 E	16.7	82 36.0 N	17.2	*.08203*	*172*	172.12	A&S
			Jul 17, 08	9.5, 11.6	20 21.8 E	.....	.....	10.2, 11.2	.08176	7	.....	A&S
			Jul 17, 08 to Jul 18, 08	20.0 to 20.0 (d. v.)	20 09.6 E	.....	.....	.....	.....	7	.....	A&S
Antoine's Bay	57 11.1 N	257 54	Jul 11, 08	13.4, 15.4	25 29.2 E	.....	.....	13.9, 14.9	.08487	7	.....	A&S
			Jul 11, 08	16.3, 17.8	25 27.8 E	16.9	82 20.8 N	17.4	*.08477*	*172*	172.12	A&S
			Jul 12, 08	8.6, 8.7	25 57.1 E	.....	.....	.....	.....	7	.....	A&S
Spruce Rock	56 43.6 N	257 30	Jul 9, 08	14.1, 16.0	22 43.4 E	.....	.....	14.6, 15.6	.08964	7	.....	A&S
			Jul 9, 08	16.6, 18.0	22 49.3 E	17.2	81 53.0 N	17.7	*.08971*	*172*	172.12	A&S
			Jul 10, 08	6.2, 6.5	22 58.6 E	.....	.....	.....	.....	7	.....	A&S
Deer's Lake	56 19.8 N	256 44	Jul 7, 08	8.6, 9.2, 10.9	20 42.8 E	.....	.....	9.7, 10.5	.09142	7	.....	A&S
			Jul 7, 08	15.5	20 33.7 E	.....	.....	.....	.....	7	.....	A&S
			Jul 7, 08	13.2, 14.6	20 32.8 E	13.7	81 43.5 N	14.2	*.09188*	*172*	172.12	A&S
			Aug 17, 08	17.4, 19.1	20 41.0 E	.....	.....	17.8, 18.6	09182	7	.....	A&S
			Aug 18, 08	4.3	20 38.7 E	4.8	81 46.0 N	5.5	*.09087*	*172*	172.12	A&S
Two Rivers	55 46.4 N	256 52	Jul 3, 08	9.9, 11.4	24 42.6 E	.....	.....	10.3, 11.0	.09858	7	.....	A&S
			Jul 3, 08	17.4, 17.6	24 39.4 E	.....	.....	.....	.....	7	.....	A&S
			Jul 3, 08	.....	.....	13.7	81 03.8 N	14.2	*.09868*	*172*	172.12	A&S
			Jul 5, 08	7.2, 8.3	24 59.0 E	.....	.....	.....	.....	7	.....	A&S
Frog Portage	55 24.3 N	256 28	Jul 1, 08	12.6, 14.0	22 02.2 E	13.0	80 48.0 N	13.5	*.10140*	*172*	172.12	A&S
			Jul 1, 08	15.4, 17.4	21 59.4 E	.....	.....	15.4, 16.9	.10140	7	.....	A&S
Pelican Narrows	55 09.6 N	257 01	Jun 29, 08	10.3, 11.7	21 31.4 E	.....	.....	10.7, 11.4	.10167	7	.....	A&S
			Jun 29, 08	17.2, 17.4	21 28.6 E	.....	.....	.....	.....	7	.....	A&S
			Jun 29, 08	.....	.....	13.7	80 45.9 N	14.1	*.10218*	*172*	172.12	A&S
			Aug 21, 08	17.1, 18.9	21 44.7 E	.....	.....	17.6, 18.5	.10421	7	.....	A&S
			Aug 21, 08	.....	.....	16.0	80 36.4 N	16.4	*.10383*	*172*	172.12	A&S
Scoop'em Rapids	54 46.4 N	257 23	Jun 26, 08	18.5, 20.7	20 23.0 E	.....	.....	19.0, 20.0	.10509	7	.....	A&S
			Jun 26, 08	.....	.....	16.1	80 25.3 N	16.7	*.10573*	*172*	172.12	A&S

NORTH AMERICA.

CANADA—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Scoop'em Rapids	54 46.4 N	257 23	Jun 27,'08	8.0, 8.2	20 36.0 E	.....	.....	.....	.....	7	.....	A&S
Sturgeon's Tent	54 23.1 N	257 52	Jun 24, 08	9.0, 10.8, 18.6	20 16.4 E	13.4	80 10.7 N	9.5, 10.3	.10791	7	172.12	A&S
			Jun 24, 08	.....	.....	.....	.....	13.9	*.10819*	*172*	.....	A&S
Norway House, C	53 58.9 N	262 08	Oct 8, 07	13.9	13 56.6 E	14.6	81 02.6 N	14.5	*.09955*	*35*	35.12	JCP
Norway House, B	53 58.8 N	262 08	Oct 8, 07	10.9	13 49.5 E	11.7	81 01.7 N	11.7	*.09945*	*35*	35.12	JCP
Norway House, A	53 58.7 N	262 08	Oct 7, 07	9.1, 11.2	14 27.8 E	10.2	81 07.7 N	10.2	*.09855*	*35*	35.12	JCP
			Oct 7, 07	13.3, 15.2	14 25.3 E	.....	.....	14.3	.09923	1	.....	JCP
Cumberland House	53 58.6 N	257 43	Jun 15, 08	18.4, 20.5	20 07.2 E	.....	.....	19.1, 19.9	.10731	7	.....	A&S
			Jun 16, 08	10.5	20 07.4 E	.....	.....	.....	.....	7	.....	A&S
			Jun 17, 08	10.4	20 10.3 E	.....	.....	9.1, 9.9	.10696	7	.....	A&S
			Jun 17, 08	11.0, 12.4	20 07.6 E	11.4	80 18.8 N	12.0	*.10730*	*172*	172.12	A&S
			Aug 25, 08	13.5, 15.2	19 53.7 E	.....	.....	14.0, 14.8	.10679	7	.....	A&S
			Aug 25, 08	11.9, 13.0	19 58.8 E	12.4	80 23.1 N	12.7	*.10656*	*172*	172.12	A&S
			Aug 25, 08 Aug 26, 08	15.0 to 15.7 (d. v.)	20 02.6 E	.....	.....	.....	.....	7	.....	A&S
The Pas, Lefroy's station	53 50.8 N	258 40	Aug 29, 08	10.4, 11.6	19 56.3 E	10.8	80 13.4 N	11.2	*.10824*	*172*	172.12	A&S
			Aug 29, 08	12.7, 14.2	19 37.8 E	.....	.....	13.1, 13.8	.10830	7	.....	A&S
The Pas	53 50.0 N	258 45	Sep 1, 08	9.6, 11.0	19 06.8 E	10.0	80 06.2 N	10.7	*.10920*	*172*	172.12	A&S
			Sep 1, 08	13.3, 14.8	18 50.6 E	.....	.....	13.7, 14.4	.10913	7	.....	A&S
Warren's Landing	53 42.9 N	262 09	Oct 10, 07	9.5	14 38.2 E	10.5	80 42.2 N	10.5	*.10382*	*35*	35.12	JCP
			Oct 10, 07	13.2, 15.0	14 39.1 E	.....	.....	14.2	.10450	1	.....	JCP
Edmonton	53 32.5 N	246 32	Oct 7, 08	13.8	27 20.3 E	13.7	77 22.0 N	14.1	*.13630*	*172*	172.12	CCS
			Oct 7, 08	15.2, 16.5	27 18.6 E	.....	.....	15.5, 16.1	.13606	7	.....	CCS
Lloydminster	53 17.6 N	250 00	Oct 6, 08	8.2	25 26.8 E	8.5	78 06.9 N	8.9	*.12904*	*172*	172.12	CCS
			Oct 6, 08	9.8, 11.4	25 25.4 E	.....	.....	10.2, 11.0	.12896	7	.....	CCS
Prince Albert	53 11.9 N	254 15	Sep 9, 08	10.1	22 47.6 E	9.8	79 16.1 N	10.4	*.11852*	*172*	172.12	CCS
			Sep 9, 08	13.4, 14.9	22 35.8 E	.....	.....	13.8, 14.6	.11858	7	.....	CCS
Melfort	52 52.6 N	255 18	Sep 15, 08	9.6, 11.0	20 58.4 E	.....	.....	10.0, 10.6	.12060	7	.....	CCS
			Sep 15, 08	14.8	20 55.0 E	14.6	78 59.9 N	15.0	*.12093*	*172*	172.12	CCS
Hudson Bay Junction	52 52.4 N	257 37	Sep 7, 08	10.5	18 49.1 E	10.9	79 20.3 N	11.4	*.11728*	*172*	172.12	CCS
			Sep 7, 08	13.4, 14.9	18 38.4 E	.....	.....	13.3, 14.6	.11745	7	.....	CCS
Battleford	52 43.5 N	251 40	Oct 5, 08	10.9	23 09.8 E	10.7	77 44.7 N	11.2	*.13327*	*172*	172.12	CCS
			Oct 5, 08	12.8, 14.2	23 02.6 E	.....	.....	13.2, 13.9	.13366	7	.....	CCS
Lacombe	52 28.7 N	246 17	Oct 9, 08	9.7, 11.2	25 57.2 E	.....	.....	10.1, 10.8	.14456	7	.....	CCS
			Oct 9, 08	13.5	25 56.4 E	13.3	76 26.3 N	13.8	*.14520*	*172*	172.12	CCS
Saskatoon	52 09.4 N	253 23	Sep 10, 08	15.6, 16.9	23 32.0 E	.....	.....	16.0, 16.6	.13600	7	.....	CCS
			Sep 11, 08	9.6	23 28.9 E	10.1	77 33.0 N	10.8	*.13607*	*172*	172.12	CCS
Swan River	52 06.7 N	258 45	Sep 17, 08	9.4, 10.7	18 40.0 E	.....	.....	9.7, 10.4	.12075	7	.....	CCS
			Sep 17, 08	13.9	18 34.6 E	13.7	79 04.2 N	14.1	*.12131*	*172*	172.12	CCS
Quill Lake	52 04.5 N	255 32	Sep 24, 08	12.3, 13.7	19 36.1 E	.....	.....	12.7, 13.3	.12679	7	.....	CCS
			Sep 24, 08	14.4	19 37.1 E	14.8	78 23.4 N	15.3	*.12729*	*172*	172.12	CCS
Kamsack	51 33.4 N	258 04	Sep 23, 08	7.9	17 13.8 E	7.7	78 45.7 N	8.2	*.12421*	*172*	172.12	CCS
			Sep 23, 08	9.5, 10.9	17 00.2 E	.....	.....	9.9, 10.6	.12363	7	.....	CCS
Rupert's House	51 30 N	281 15	Aug 16, 09	9.3	16 02.0 W	9.2, 10.0	80 13.9 N	9.6	*.10625*	*202*	202.1256	CCS
			Aug 16, 09	10.7, 11.8	16 12.0 W	.....	.....	14.0, 14.6	.10650	11	.....	CCS
			Aug 16, 09	13.0, 15.0	16 11.2 W	.....	.....	.....	.....	11	.....	CCS
Sandy Island	51 23.5 N	282 38	Aug 26, 09	7.4 to 23.0(8)	17 27.6 W	.....	.....	.....	.....	11	.....	CCS
			Aug 27, 09	7.8, 8.8	17 19.7 W	10.7	80 12.2 N	8.2, 8.5	.10578	11	202.12	CCS
			Aug 27, 09	.....	.....	.....	.....	10.7	*.10621*	*202*	.....	CCS
Ka-ba-she Bowstek	51 22.8 N	281 51	Aug 20, 09	13.7	15 57.8 W	13.7	80 12.8 N	13.7	*.10615*	*202*	202.1256	CCS
			Aug 20, 09	16.2, 17.0	16 00.8 W	.....	.....	16.5, 16.8	.10568	11	.....	CCS
			Aug 21, 09	7.2, 8.3	15 46.8 W	.....	.....	7.5, 8.7	.10547	11	.....	CCS
			Aug 21, 09	9.0, 10.8	15 55.0 W	.....	.....	.....	.....	11	.....	CCS
Marten Creek	51 19.8 N	283 40	Sep 1, 09	13.6	18 03.1 W	13.6	79 50.0 N	13.6	*.10989*	*202*	202.1256	CCS
			Sep 1, 09	15.2, 16.2	17 59.6 W	.....	.....	15.6, 15.9	.10962	11	.....	CCS
Nemaska	51 17.2 N	283 10	Aug 30, 09	9.6	19 49.8 W	9.6	80 46.1 N	9.6	*.10157*	*202*	202.1256	CCS
			Aug 30, 09	11.4, 13.0	19 43.8 W	.....	.....	13.3, 13.7	.10142	11	.....	CCS
			Aug 30, 09	13.9, 14.8	19 34.4 W	.....	.....	.....	.....	11	.....	CCS
Moose Factory	51 16.5 N	279 26	Aug 7, 09	10.7	17 01.6 W	10.7	80 39.3 N	10.8	*.10333*	*202*	202.1256	CCS
			Aug 7, 09	14.5, 15.4, 16.4	16 59.3 W	.....	.....	14.8, 15.1	.10328	11	.....	CCS
			Aug 7, 09	.....	.....	.....	.....	16.7	.10382	11	.....	CCS
			Aug 9, 09	5.7 to 19.2 (d.v.)	16 57.3 W	.....	.....	.....	.....	11	.....	CCS
Glacier	51 15.9 N	242 27	Sep 30, 07	13.7, 15.2	25 54.6 E	10.8	74 29.9 N	14.5	.16206	1	35.12	JCP
			Sep 30, 07	.....	.....	.....	.....	10.8	*.16253*	*35*	.....	JCP
Junction	51 13.5 N	285 56	Sep 16, 09	10.4	21 08.4 W	10.4	79 29.7 N	10.4	*.11257*	*202*	202.12	CCS
			Sep 16, 09	13.6, 14.7	21 13.4 W	.....	.....	14.0, 14.5	.11334	11	.....	CCS
			Sep 16, 09	16.8, 17.6	21 06.5 W	.....	.....	.....	.....	11	.....	CCS

NORTH AMERICA.

CANADA—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Banff, Tunnel Mt.	51 10.6 N	244 27	Jul 16,'07	15.5, 17.2	25 52.8 E	16.1	74 57.3 N	16.0	.15940	21	24.12	LAB
Dauphin	51 10.6 N	259 57	Sep 22, 08	9.2, 10.7, 10.9	15 01.9 E	13.4	78 23.0 N	9.5, 10.4	.12830	7	172.12	CCS
			Sep 22, 08	13.0	14 55.2 E	.....	.....	13.7(wt.½)	*.12921*	*172*	.....	CCS
Banff, Park	51 10.4 N	244 26	Jul 18, 07	10.6, 11.4, 12.4	25 58.2 E	11.7, 16.6	74 57.5 N	11.0, 15.6	.15914	21	24.12	LAB
			Jul 18, 07	15.6, 17.1	25 50.8 E	.....	.....	.....	.....	21	.....	LAB
Netting Place	51 09.9 N	284 22	Sep 7, 09	14.3	20 05.8 W	14.4	79 30.8 N	14.4	*.11346*	*202*	202.1256	CCS
			Sep 7, 09	15.6, 16.5	20 01.6 W	.....	.....	15.9, 16.3	.11302	11	.....	CCS
Banff, Sulphur Mt.	51 08.7 N	244 26	Jul 17, 07	14.0, 14.8, 15.7	25 45.4 E	15.3	74 54.0 N	14.5	.15911	21	24.12	LAB
Little Loon Lake	51 08.2 N	285 00	Sep 10, 09	10.6	19 21.0 W	10.1	79 32.2 N	10.6	*.11260*	*202*	202.1256	CCS
			Sep 10, 09	12.9, 13.7	19 33.7 W	.....	.....	13.2, 13.5	.11289	11	.....	CCS
			Sep 10, 09	14.5, 15.6	19 31.2 W	.....	.....	14.8, 15.3	.11280	11	.....	CCS
			Sep 11, 09	7.2, 9.3	19 24.9 W	.....	.....	.....	.....	11	.....	CCS
			Sep 11, 09	11.4, 13.3, 17.2	19 31.4 W	.....	.....	.....	.....	11	.....	CCS
Portage Lake	51 06.3 N	284 02	Sep 3, 09	16.7, 17.6	17 58.8 W	.....	.....	17.0, 17.3	.11391	11	.....	CCS
			Sep 4, 09	13.3	18 14.4 W	13.0	79 28.2 N	13.5	*.11373*	*202*	202.12	CCS
			Sep 4, 09	14.3, 14.9	18 17.6 W	.....	.....	.....	.....	11	.....	CCS
Calgary	51 02.8 N	245 58	Oct 10, 08	9.6, 10.9	25 14.0 E	13.7	75 19.0 N	10.0, 10.6	.15617	7	172.12	CCS
			Oct 10, 08	13.9	25 12.0 E	.....	.....	14.1	*.15648*	*172*	.....	CCS
Mistassini Lake	50 59.7 N	286 08	Sep 20, 09	10.2	20 54.4 W	10.3	79 22.9 N	10.3	*.11361*	*202*	202.1256	CCS
			Sep 20, 09	12.5, 14.4	21 02.8 W	.....	.....	13.0, 14.0	.11389	11	.....	CCS
Red Rock	50 56.9 N	278 58	Aug 5, 09	9.0, 11.2, 14.3	11 08.8 W	10.2	79 54.7 N	15.2	.11051	11	202.1256	CCS
			Aug 5, 09	15.8, 16.8, 17.7	11 10.3 W	.....	.....	18.2, 18.7	.11062	11	.....	CCS
			Aug 5, 09	10.2	11 04.2 W	.....	.....	10.2	*.11052*	*202*	.....	CCS
Ashcroft	50 43.6 N	238 43	Sep 27, 07	10.2	27 41.0 E	10.2	73 22.3 N	10.2	*.17274*	*35*	35.12	JCP
			Sep 27, 07	13.7, 15.4	27 32.0 E	.....	.....	14.6	.17223	1	.....	JCP
			Sep 28, 07	10.6, 15.0	27 29.1 E	.....	.....	.....	.....	1	.....	JCP
Big Opatook	50 40.3 N	286 11	Sep 5, 10	10.1, 12.6	20 49.4 W	14.6	78 57.1 N	10.7, 11.5	.11792	10	178.(567)	PNS
			Sep 5, 10	14.4	20 58.8 W	.....	.....	14.6(wt.½)	*.11839*	*178*	.....	PNS
Oak Point	50 29.7 N	261 57	Sep 30, 08	14.9	13 36.8 E	15.8	78 20.2 N	.....	.....	7	172.12	CCS
			Sep 30, 08	16.1	13 37.6 E	.....	.....	.....	.....	*172*	.....	CCS
			Oct 1, 08	7.9, 9.2	13 33.4 E	.....	.....	8.2, 8.9	.12777	7	.....	CCS
Regina	50 26.4 N	255 24	Sep 25, 06	8.9, 11.2	19 13.5 E	9.8	76 56.8 N	10.5	*.14274*	*177*	177.567	EHB
Misstassinny	50 25.7 N	286 07	Sep 24, 09	14.2	20 14.4 W	14.2	78 56.3 N	14.6	*.11848*	*202*	202.12	CCS
			Sep 24, 09	16.1, 17.2	20 13.2 W	.....	.....	16.4, 16.9	.11836	11	.....	CCS
			Sep 25, 09	14.0	20 15.9 W	.....	.....	.....	.....	*202*	.....	CCS
			Sep 27, 09	8.0 to 16.9 (d.v.)	20 22.0 W	.....	.....	.....	.....	11	.....	CCS
Island Rapids	50 24.6 N	278 26	Aug 3, 09	10.4	9 31.6 W	10.4	79 12.2 N	10.4	*.11951*	*202*	202.12	CCS
			Aug 3, 09	12.6, 13.8	9 38.2 W	.....	.....	13.0, 13.5	.11955	11	.....	CCS
			Aug 3, 09	16.5, 17.5	9 31.1 W	.....	.....	.....	.....	11	.....	CCS
Broadview	50 23.5 N	257 25	Sep 24, 06	12.4, 14.9, 16.0	17 00.0 E	13.5	77 37.5 N	15.5	*.13573*	*177*	177.567	EHB
File Axe Lake	50 19.4 N	286 22	Sep 8, 10	13.9	21 14.1 W	13.8	78 43.7 N	13.8(wt.½)	*.12043*	*178*	178.(567)	PNS
			Sep 9, 10	10.0, 11.8	21 06.5 W	.....	.....	10.6, 11.5	.12013	10	.....	PNS
Gladstone	50 13.4 N	261 02	Sep 28, 08	9.2, 10.6, 11.0	14 04.2 E	13.5	78 01.6 N	9.6, 10.2	.13092	7	172.12	CCS
			Sep 28, 08	13.7	14 13.0 E	.....	.....	14.0	*.13163*	*172*	.....	CCS
West Selkirk	50 09.9 N	263 08	Oct 15, 07	10.5	13 10.0 E	10.5	78 45.6 N	10.5	*.12451*	*35*	35.12	JCP
			Oct 15, 07	13.8, 15.5	13 20.8 E	.....	.....	14.7	.12574	1	.....	JCP
Kirkella	50 01.6 N	258 38	Sep 24, 06	5.9, 7.8	16 06.4 E	6.6	77 17.0 N	7.3	*.13987*	*177*	177.567	EHB
Wakonichi Lake	50 01.1 N	285 44	Aug 31, 10	13.8, 16.4	20 29.8 W	.....	.....	14.4, 15.8	.11406	10	.....	PNS
			Sep 1, 10	6.5	20 23.8 W	7.8	79 14.0 N	7.8(wt.½)	*.11374*	*178*	178.(567)	PNS
New Post	49 59.9 N	278 29	Jul 31, 09	9.2, 11.1	9 05.6 W	9.3, 11.1	79 24.2 N	9.9, 10.3	*.11570*	*202*	202.1256	CCS
			Jul 31, 09	14.6, 15.9	9 09.4 W	.....	.....	15.0, 15.6	.11578	11	.....	CCS
Chibougaman	49 56.9 N	285 50	Oct 2, 09	9.2	16 41.0 W	9.1	76 46.5 N	9.1	*.14227*	*202*	202.1256	CCS
			Oct 2, 09	7.6, 10.8	16 38.6 W	.....	.....	13.9, 14.4	.14362	11	.....	CCS
			Oct 2, 09	13.5, 15.8	16 43.8 W	.....	.....	.....	.....	11	.....	CCS
Grindstone River	49 55.1 N	286 18	Sep 13, 10	8.5, 10.8	20 04.6 W	13.6	78 28.1 N	9.1, 10.2	.12230	10	178.(567)	PNS
			Sep 13, 10	13.6	20 16.4 W	.....	.....	13.6	*.12273*	*178*	.....	PNS
Brandon	49 52.1 N	260 02	Sep 22, 06	7.5, 10.5	15 02.6 E	9.2	77 28.6 N	10.0	*.13798*	*177*	177.567	EHB
Winnipeg	49 51.8 N	262 51	Sep 21, 06	11.1, 13.7	13 52.2 E	12.6	78 07.5 N	13.2	*.13160*	*177*	177.567	EHB
			Jul 13, 07	14.3, 15.4, 17.2	13 48.6 E	16.5	78 10.4 N	14.8	.13049	21	24.12	LAB
			Jun 9, 08	9.3, 11.6	13 56.3 E	14.0	78 08.5 N	10.1, 11.2	.13082	7	172.12	A&S
			Jun 9, 08	.....	.....	.....	.....	14.6	*.13128*	*172*	.....	A&S
Little Lakes Portage	49 49.3 N	278 30	Jul 27, 09	18.3	10 17.8 W	.....	.....	18.6	.12160	11	.....	CCS
			Jul 28, 09	6.8, 10.7, 11.1	10 18.6 W	8.4	78 51.4 N	6.5	.12143	11	202.12	CCS
			Jul 28, 09	8.6	10 10.0 W	.....	.....	8.4	*.12193*	*202*	.....	CCS
Eagle River	49 47.9 N	266 49	Sep 18, 06	16.2	6 35.2 E	16.9 (wt.5)	78 07.0 N	17.5	*.13118*	*177*	177.127	EHB
			Sep 19, 06	9.8, 10.9	6 36.1 E	10.4	78 11.2 N	10.4	*.13145*	*177*	177.3	EHB
Kenora	49 46.2 N	265 34	Sep 20, 06	9.8, 12.5	9 49.1 E	10.5	77 58.9 N	11.1	*.13171*	*177*	177.567	EHB

NORTH AMERICA.

CANADA—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Macleod	49 42.1 N	246 36	Oct 12,'08	9.6, 10.8	23 32.8 E	13.4	74 37.7 N	9.9, 10.5	.16344	7	172.12	CCS
			Oct 12, 08	13.1	23 30.2 E	.....	.....	13.8	*.16338*	*172*	.....	CCS
Height of Land	49 32.8 N	285 42	Oct 7, 09	11.3, 16.0, 16.8	18 33.9 W	14.0	78 23.2 N	16.4	.12398	11	202.1256	CCS
			Oct 7, 09	14.0	18 34.7 W	.....	.....	14.0	*.12419*	*202*	.....	CCS
Muskrat Lake	49 26.9 N	285 46	Aug 26, 10	11.0, 16.0	18 34.6 W	.....	.....	13.0, 15.4	.12506	10	.....	PNS
			Aug 26, 10	17.3	18 42.0 W	.....	.....	.....	.....	*178*	.....	PNS
			Aug 27, 10	.....	.....	6.3	78 17.6 N	6.3(wt.½)	*.12485*	*178*	178.(567)	PNS
Singed Marten Creek	49 26.7 N	278 41	Jul 26, 09	14.0	10 59.6 W	14.0	78 55.1 N	14.0	*.12137*	*202*	202.1256	CCS
			Jul 26, 09	16.7, 18.2	10 52.2 W	.....	.....	17.1, 17.7	.12104	11	.....	CCS
Ignace	49 25.2 N	268 20	Sep 17, 06	15.0, 17.0	6 12.0 E	15.8	78 27.3 N	16.4	*.12786*	*177*	177.567	EHB
			Sep 18, 06	7.2, 9.2	6 17.6 E	7.9	78 27.6 N	8.6	*.12770*	*177*	177.123	EHB
Lauder	49 23.6 N	259 17	Sep 27, 06	15.9, 17.7	16 08.8 E	16.5(wt.5)	76 53.8 N	17.2	*.14315*	*177*	177.567	EHB
			Sep 28, 06	8.0	16 08.7 E	8.6	76 53.7 N	8.6	*.14320*	*177*	177.3	EHB
Badger	49 11.5 N	264 04	Oct 2, 06	9.0, 10.8	11 07.0 E	9.6	77 35.7 N	10.3, 14.5	*.13684*	*177*	177.567	EHB
			Oct 2, 06	13.3, 14.9	11 00.0 E	14.0	77 37.1 N	.....	.....	*177*	177.123	EHB
Estevan	49 08.7 N	257 02	Sep 26, 06	10.2, 13.4, 14.6	17 27.4 E	11.6	76 18.4 N	14.1	*.14887*	*177*	177.567	EHB
Swabmooswan	49 08.4 N	286 19	Oct 10, 09	9.8	17 22.9 W	9.8	78 22.4 N	9.8	*.12382*	*202*	202.1256	CCS
			Oct 10, 09	13.6, 14.8, 16.5	17 26.6 W	.....	.....	14.0, 14.5	.12388	11	.....	CCS
Abitibi Crossing	49 02.0 N	279 07	Jul 24, 09	9.2, 10.4	10 03.3 W	13.1	78 40.1 N	9.6, 10.1	.12251	11	202.12	CCS
			Jul 24, 09	13.1	10 14.5 W	.....	.....	13.1	*.12336*	*202*	.....	CCS
Nipigon	49 00.9 N	271 44	Sep 14, 06	8.6, 11.0, 13.6	1 15.1 E	9.4	78 28.7 N	10.5	*.12730*	*177*	177.567	EHB
Long Falls	48 59.3 N	286 54	Oct 14, 09	10.1	22 09.9 W	9.5, 10.6	77 42.0 N	10.0	*.13159*	*202*	202.1256	CCS
			Oct 14, 09	13.0, 14.1	22 13.4 W	.....	.....	13.3, 13.8	.13160	11	.....	CCS
			Oct 14, 09	14.9, 15.4	22 11.3 W	.....	.....	.....	.....	11	.....	CCS
			Aug 19, 10	9.4, 12.2	21 47.0 W	14.4	77 35.9 N	10.2, 11.6	.13190	10	178.(567)	PNS
			Aug 19, 10	14.2	22 05.6 W	.....	.....	14.4 (wt.½)	*.13241*	*178*	.....	PNS
Savanne	48 58.2 N	269 46	Sep 17, 06	8.9, 10.4	4 33.6 E	9.5	78 10.0 N	10.0	*.13026*	*177*	177.567	EHB
Mistassini	48 54.5 N	287 46	Sep 21, 06	11.2 to 17.1(7)	19 26.6 W	16.2	78 19.4 N	11.8	.12490	21	24.12	LAB
			Sep 22, 06	8.4 to 14.8(19)		11.8	78 16.6 N	10.1	.12489	21	24.12	LAB
			Oct 20, 09	10.4	19 39.0 W	10.5	78 16.4 N	10.5	*.12482*	*202*	202.1256	CCS
			Oct 20, 09	15.6, 16.1	19 38.7 W	.....	.....	14.9, 15.4	.12476	11	.....	CCS
Schreiber	48 48.8 N	272 42	Sep 13, 06	9.7, 12.4, 15.0	0 25.2 W	10.6	78 24.9 N	11.3	*.12696*	*177*	177.567	EHB
Farrington	46 48.2 N	267 12	Oct 4, 06	8.8, 10.9	7 41.0 E	9.6	77 41.8 N	10.3	*.13479*	*177*	177.567	EHB
			Oct 4, 06	12.8, 14.7	7 31.9 E	13.5	77 43.2 N	14.1	*.13478*	*177*	177.123	EHB
Peribonka	48 46.1 N	287 55	Sep 20, 06	13.4	21 06.3 W	13.8	77 27.4 N	13.5	.13273	21	24.12	LAB
Twin Falls	48 45.5 N	279 27	Jul 11, 09	10.7	9 51.0 W	11.3	78 24.4 N	11.3	*.12590*	*202*	202.12	CCS
			Jul 11, 09	15.0, 16.3, 18.4	9 55.5 W	.....	.....	15.4, 16.0	.12573	11	.....	CCS
The Narrows	48 43.3 N	280 07	Jul 14, 09	13.0, 14.3	10 37.6 W	17.5	78 12.4 N	13.4, 14.0	.12748	11	202.12	CCS
			Jul 14, 09	17.6	10 26.3 W	.....	.....	17.5	*.12812*	*202*	.....	CCS
Rainy River	48 42.9 N	265 29	Oct 3, 06	9.3, 11.2	9 32.8 E	10.0	77 26.7 N	10.7, 15.7	*.13743*	*177*	177.567	EHB
			Oct 3, 06	14.4, 16.3	9 29.4 E	15.0	77 27.7 N	.....	.....	*177*	177.123	EHB
Abitibi Lake	48 39.8 N	280 44	Jul 16, 09	10.4 to 24.0(5)	10 37.8 W	15.3	78 16.2 N	11.2, 18.7	.12633	11	202.1256	CCS
			Jul 16, 09	15.3	10 36.9 W	.....	.....	15.3	*.12691*	*202*	.....	CCS
			Jul 17, 09	5.3 to 9.0(3)	10 29.9 W	.....	.....	.....	.....	11	.....	CCS
White River	48 35.8 N	274 42	Sep 12, 06	6.1, 9.0	2 53.4 W	7.0	78 16.0 N	8.4	*.12893*	*177*	177.567	EHB
Matheson, B	48 32 N	279 33	Jul 10, 09	9.7, 11.1	9 42.9 W	.....	.....	10.4	.12330	11	.....	CCS
Matheson, A	48 31.5 N	279 33	Jul 1, 09	9.3	9 20.6 W	9.3	78 47.8 N	9.3	*.12130*	*202*	202.12	CCS
			Jul 1, 09	16.3	9 28.3 W	.....	.....	16.6	.12203	11	.....	CCS
Roberval	48 30.8 N	287 46	Sep 20, 06	7.2, 7.6	19 36.5 W	6.8	77 33.5 N	7.4	.13290	21	24.12	LAB
Chicoutimi	48 25.1 N	288 57	Sep 19, 06	15.1, 15.4, 16.2	20 19.9 W	16.7	77 36.9 N	15.7	.13332	21	24.12	LAB
Victoria	48 24.5 N	236 36	Aug 28, 07	16.9, 17.8	24 10.3 E	18.6	71 20.2 N	17.4	.18822	21	24.12	LAB
			Aug 29, 07	13.9, 14.7	24 16.0 E	15.8	71 15.6 N	14.4	.18814	21	24.12	LAB
Fort William	48 23.7 N	270 45	Sep 15, 06	16.4, 18.1	3 36.5 E	17.0	77 48.0 N	17.6	*.13404*	*177*	177.567	EHB
St. Alphonse	48 21.2 N	289 06	Sep 19, 06	9.2, 9.7, 10.4	21 53.7 W	10.1	77 56.1 N	9.4	.12771	21	24.12	LAB
Missinaibie	48 19.5 N	275 53	Aug 29, 05	14.8	5 21.1 W	11.8	77 55.3 N	15.8, 16.9	.13216	8 CS	35.12	B&B
			Aug 30, 05	.....	.....	.....	.....	15.4, 16.5	.13226	8 CS	.....	B&B
			Sep 11, 06	9.1, 11.3, 15.4	5 40.5 W	9.8	77 51.7 N	10.7	*.13290*	*177*	177.567	EHB
Missinaibie, Eclipse Sta.	48 19.5 N	275 53	Aug 30, 05	8.0, 8.6	4 55.8 W	13.4	77 58.2 N	13.4	*.13163*	*35*	35.3	B&B
Twin Lake	48 16.5 N	279 43	Oct 11, 06	7.2, 8.2	7 43.6 W	6.8	77 39.4 N	7.8	.13642	21	24.12	LAB
Riviere du Loup	47 50.3 N	290 27	Sep 18, 06	8.1 to 15.2(8)	20 41.6 W	8.4, 15.7	76 34.1 N	8.6	.14070	21	24.12	LAB
Englehart	47 49.9 N	280 07	Jun 30, 09	9.1, 10.3	8 55.3 W	11.3	77 51.4 N	9.5, 10.0	.13088	11	202.12	CCS
			Jun 30, 09	13.2, 14.6	9 08.7 W	.....	.....	.....	.....	11	.....	CCS
			Jun 30, 09	11.2	9 05.7 W	.....	.....	11.3	*.13178*	*202*	.....	CCS
Chapleau	47 49.6 N	276 33	Oct 10, 06	8.9, 11.6	4 01.4 W	10.2	77 50.7 N	11.0	*.13279*	*177*	177.567	EHB
Englehart	47 49.6 N	280 08	Oct 10, 06	9.9, 10.8	9 05.7 W	11.3, 17.2	77 49.6 N	10.3, 16.6	.13194	21	24.12	LAB
			Oct 10, 06	16.4, 17.7	9 06.6 W	.....	.....	.....	.....	21	.....	LAB
Lake Edward	47 40.1 N	287 45	Sep 24, 06	10.0, 10.5	19 34.2 W	11.6	76 54.2 N	10.5	.13870	21	24.12	LAB
			Sep 24, 06	11.1, 12.0	19 37.6 W	.....	.....	.....	.....	21	.....	LAB

NORTH AMERICA.

CANADA—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	I′			
New Liskeard	47 31 N	280 18	Oct 9,'06	9.8, 10.7, 12.9	8 49.7 W	11.2	77 34.7 N	10.2	.13469	21	24.12	LAB
			Jun 29, 09	10.0	8 46.5 W	10.6	77 34.1 N	10.6	*.13399*	*202*	202.12	CCS
			Jun 29, 09	13.6, 14.7	8 52.4 W	.....	.....	13.9, 14.3	.13386	11	.....	CCS
Edmundston, A	47 22.9 N	291 40	Sep 16, 06	11.2, 12.4	21 11.9 W	10.2	76 18.1 N	11.7	.14184	21	24.12	LAB
Edmundston, B	47 22.9 N	291 40	Sep 16, 06	15.9, 16.9	21 08.5 W	17.5	76 19.4 N	16.4	.14225	21	24.12	LAB
Biscotasing	47 17.8 N	277 52	Sep 10, 06	7.5, 10.9, 13.3	3 07.8 W	8.6	77 09.4 N	10.2	*.13833*	*177*	177.567	EHB
Mishomis*	47 12.8 N	284 22	Oct 3, 06	8.8, 9.7	12 47.0 W	11.2	77 04.2 N	9.4	.13905	21	24.12	LAB
			Oct 3, 06	10.6, 12.1	12 50.5 W	.....	.....	.....	.....	21	.....	LAB
Timagami Station*	47 03.7 N	280 13	Oct 13, 06	13.9	11 59.5 W	13.3	76 05.9 N	14.1	.15195	21	24.12	LAB
Timagami Inn*	46 58.3 N	279 58	Oct 13, 06	7.5, 8.5	11 23.9 W	7.0	76 47.4 N	8.2	.14267	21	24.12	LAB
Baskatong	46 48.8 N	284 08	Oct 4, 06	13.3, 14.3	12 23.9 W	15.1	76 38.5 N	13.7	.14159	21	24.12	LAB
Quebec	46 48.1 N	288 46	Sep 25, 06	13.8, 14.7, 17.3	18 00.2 W	15.8, 16.4	75 58.7 N	14.2, 17.2	.14780	21	24.12	LAB
			Oct 25, 09	11.7	18 15.4 W	11.6	76 02.7 N	11.6	*.14704*	*202*	202.1256	CCS
			Oct 25, 09	13.2 to 15.3(4)	18 19.1 W	.....	.....	13.5, 14.1	.14708	11	.....	CCS
Kippewa	46 46.8 N	281 01	Oct 7, 06	10.3, 15.7, 17.2	9 45.1 W	11.3, 16.6	76 41.8 N	10.5, 15.5	.14285	21	24.12	LAB
Timiskaming	46 43.6 N	280 54	Oct 8, 06	.....	.....	10.9	76 42.8 N	10.2	.14291	21	24.12	LAB
Sudbury	46 30 N	279 00	Sep 8, 06	16.1, 18.0	6 28.0 W	16.8	76 22.1 N	17.5	*.14761*	*177*	177.567	EHB
Maniwaki	46 22.6 N	284 01	Sep 30, 06	16.7, 17.4	12 22.2 W	17.9	76 29.3 N	17.0	.14401	21	24.12	LAB
			Oct 5, 06	.....	.....	13.4	76 29.7 N	.....	.....	..	24.12	LAB
Three Rivers	46 20.9 N	287 27	Sep 26, 06	12.7, 13.8, 15.4	15 29.9 W	14.8	75 57.1 N	13.1	.14852	21	24.12	LAB
Mattawa	46 19.5 N	281 17	Oct 20, 08	14.0	8 53.1 W	13.9	76 40.6 N	14.3	*.14360*	*172*	172.12	CCS
			Oct 20, 08	15.7	8 52.9 W	.....	.....	9.7, 10.4	.14286	7	.....	CCS
			Oct 21, 08	9.3, 10.7	8 49.0 W	13.7	76 40.2 N	9.6, 10.3	.14283	7	172.12	CCS
			Oct 21, 08	13.3	8 52.2 W	.....	.....	14.1	*.14314*	*172*	.....	CCS
			Jun 26, 09	9.9, 11.2	8 53.3 W	14.1	76 40.5 N	10.4, 11.0	.14274	11	202.1256	CCS
			Jun 26, 09	14.1	8 59.0 W	.....	.....	14.1	*.14311*	*202*	.....	CCS
North Bay	46 18.8 N	280 34	Sep 15, 06	13.6, 15.5	8 46.6 W	10.2	76 37.3 N	14.1, 14.9	.14443	20	172.12	PHD
			Oct 11, 06	9.4, 11.4	8 41.8 W	10.9	76 37.9 N	12.6, 15.1	*.14395*	*177*	177.567	EHB
			Oct 11, 06	14.0, 15.7	8 43.9 W	13.8	76 37.8 N	.....	.....	*177*	177.123	EHB
			Oct 14, 06	9.4, 10.4	8 46.7 W	8.8, 11.3	76 37.1 N	10.1	.14387	21	24.12	LAB
			Oct 14, 06	11.9, 12.2	8 49.7 W	.....	.....	.....	.....	21	.....	LAB
			Jul 3, 09	11.1	9 01.0 W	11.2	76 37.0 N	11.2	*.14412*	*202*	202.12	CCS
			Jul 3, 09	13.3, 14.6	9 00.8 W	.....	.....	13.8, 14.3	.14368	11	.....	CCS
Labelle	46 16.4 N	285 17	Sep 27, 06	16.1, 17.0, 18.0	15 26.6 W	17.5	76 29.8 N	16.6	.14310	21	24.12	LAB
Charlottetown	46 13.5 N	296 52	Oct 6, 08	13.6, 15.5	23 50.2 W	.....	.....	14.3, 15.1	.15341	1	.....	CCC
			Oct 7, 08	7.3	23 43.2 W	6.9	74 59.3 N	7.6	*.15368*	*35*	35.12	CCC
Algoma	46 11.3 N	277 10	Oct 9, 06	8.6, 10.5	4 31.3 W	9.4	76 24.1 N	10.0	*.14655*	*177*	177.567	EHB
Sydney	46 08.8 N	299 48	Sep 21, 05	17.1	25 15.9 W	17.2	74 22.7 N	.....	.....	*172*	172.12	JEB
			Sep 22, 05	9.5, 9.9, 15.4	25 14.5 W	10.5	74 23.3 N	.....	.....	*172*	172.12	JEB
			Sep 23, 05	11.3, 15.2, 17.4	25 13.8 W	11.4, 15.3	74 22.6 N	10.7	*.15662*	*172*	172.12	JEB
			Sep 23, 05	.....	.....	10.7, 15.8	74 24.2 N	14.7, 16.8	*.15642*	*172*	172.3	JEB
			Jul 7, 08	13.7, 15.6	25 25.0 W	.....	.....	14.3, 15.1	.15708	1	.....	CCC
			Jul 8, 08	9.6, 12.4	25 21.8 W	10.3	74 17.0 N	11.7	*.15716*	*35*	35.12	CCC
			Jul 9, 08	8.6, 10.8	25 19.0 W	9.2	74 17.4 N	10.1	*.15706*	*35*	35.12	CCC
			Jul 10, 08	9.2, 11.0	25 20.6 W	.....	.....	9.8, 10.6	.15671	1	.....	CCC
			Jul 13, 08	.....	.....	13.8	74 18.1 N	14.6	*.15714*	*35*	35.12	CCC
			Aug 7, 09	11.7, 14.5	25 32.0 W	15.4	74 12.2 N	14.0	.15719	4	201.12	EK
Sydney, Secondary	46 08.8 N	299 48	Sep 25, 05	10.6	25 08.0 W	.....	.....	.....	.....	*172*	.....	JEB
Chalk River	46 00.5 N	282 34	Oct 15, 06	9.2, 10.0, 10.4	10 20.5 W	10.8, 11.4	76 23.5 N	9.6, 13.6	.14596	21	24.12	LAB
			Oct 15, 06	11.9, 13.3, 13.8	10 24.4 W	.....	.....	.....	.....	21	.....	LAB
St. Jerome	45 46.5 N	286 01	Sep 28, 06	10.9, 11.3	15 52.0 W	10.4	76 08.2 N	11.1	.14859	21	24.12	LAB
Hawkesbury	45 36.0 N	285 23	Sep 28, 06	14.8, 15.1	11 54.8 W	15.5	76 03.1 N	14.9	.14991	21	24.12	LAB
McAdam Junction	45 34.5 N	292 40	Sep 15, 06	8.8	18 57.2 W	9.2	75 12.1 N	9.0	.15312	21	24.12	LAB
Emsdale	45 32.3 N	280 42	Sep 14, 06	9.4, 11.2	7 53.4 W	13.5	75 49.2 N	10.0, 10.7	.15186	20	172.12	PHD
Montreal	45 30.5 N	286 29	Sep 27, 06	.....	.....	7.6	75 38.1 N	.....	.....	..	24.12	LAB
Madawaska	45 30.3 N	282 01	Sep 18, 06	7.4, 9.4, 10.7	9 05.0 W	8.0	75 53.4 N	10.0	*.15018*	*172*	172.12	PHD
Renfrew	45 29.1 N	283 20	Sep 19, 06	10.0, 13.3	11 17.1 W	14.4	75 47.2 N	10.6, 11.2	.15118	20	172.12	PHD
Ottawa	45 23.6 N	284 17	Oct 15, 06	.....	.....	14.8	75 38.4 N	15.5	*.15231*	*172*	172.12	PHD
			Oct 16, 06	10.7, 13.4	12 47.6 W	.....	.....	11.3, 13.8	.15204	20	.....	PHD
			Oct 16, 06	.....	.....	.....	.....	14.3	.15219	20	.....	PHD
St. John	45 17.0 N	293 52	Sep 30, 05	10.8, 11.1, 14.4	20 57.3 W	12.5, 13.9	74 22.8 N	12.9, 13.5	*.16094*	*172*	172.123	JEB
			Aug 5, 09	12.9, 14.7	21 12.4 W	16.5	74 21.3 N	13.6	.16053	4	201.12	EK
Kinmount	44 47.1 N	281 21	Sep 24, 06	.....	.....	16.5	75 18.7 N	.....	.....	..	172.12	PHD
			Sep 25, 06	9.8, 11.5	8 23.7 W	.....	.....	10.3, 11.0	.15569	20	.....	PHD
Penetanguishene	44 46.8 N	280 05	Sep 12, 06	16.3, 18.1	7 00.1 W	.....	.....	16.8, 17.5	.15543	20	.....	PHD
			Sep 13, 06	.....	.....	8.1	75 28.3 N	.....	.....	..	172.12	PHD

* Local disturbance.

NORTH AMERICA.

CANADA—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Black Point	44 38.5 N	295 50	Sep 27,'05	9.8 to 16.4(4)	21 04.2 W	11.0, 15.1	73 59.5 N	10.5, 15.1	*.16191*	*172*	172.123	JEB
			Sep 28, 05	8.6, 8.9	21 02.9 W	.....	.....	.....	.....	*172*	.....	JEB
Halifax	44 36.4 N	296 32	Sep 29, 05	10.3, 12.5 14.8	20 54.8 W	11.0, 14.1	73 58.8 N	11.4, 13.4	*.16187*	*172*	172.123	JEB
Owen Sound	44 34.6 N	279 03	Sep 27, 06	14.3, 16.3	5 49.0 W	10.7	75 11.2 N	15.0, 15.8	.15888	20	172.12	PHD
Peterborough	44 18.2 N	281 42	Sep 22, 06	9.7, 11.5	8 17.7 W	13.8	74 43.4 N	10.2, 11.0	.16459	20	172.12	PHD
Kingston Junction	44 15.6 N	283 32	Sep 21, 06	10.3, 12.1	13 29.2 W	13.2	74 57.8 N	10.8, 11.5	.16193	20	172.12	PHD
Agincourt (Magnetic Observatory)	43 47 N	280 44	Sep 5, 06	.....	.....	.....	.....	12.3, 13.1	.16364	20	.....	PHD
			Sep 5, 06	.....	.....	.....	.....	14.4, 15.3	.16404	20	.....	PHD
			Sep 6, 06	10.4, 13.3	5 49.6 W	15.0	74 36.4 N	10.9, 11.8	.16356	20	172.12	PHD
			Sep 7, 06	15.5, 16.0	5 48.6 W	14.0	74 36.5 N	.....	.....	20	172.12	PHD
			Sep 8, 06	10.0, 12.0	5 47.6 W	13.8, 14.9	74 35.8 N	10.4, 11.1	.16357	20	172.12	PHD
			Sep 10, 06	.....	.....	14.0, 15.3	74 35.4 N	9.7, 10.4	.16343	20	172.12	PHD
			Sep 10, 06	.....	.....	.....	.....	11.1, 12.2	.16366	20	.....	PHD
			Oct 8, 06	10.5, 12.6	5 49.7 W	.....	.....	11.1, 12.1	.16357	20	.....	PHD
			Oct 8, 06	13.2, 15.8	5 49.4 W	.....	.....	14.1, 15.1	.16383	20	.....	PHD
			Oct 9, 06	.....	.....	.....	.....	10.0 to				
			Oct 9, 06					14.9(6)	.16373	20	.....	PHD
			Oct 10, 06	9.3, 10.9	5 44.5 W	14.4, 15.6	74 35.6 N	9.8, 10.5	.16374	20	172.12	PHD
			Oct 11, 06	.....	.....	9.7, 10.8	74 37.2 N	.....	.....	..	172.12	PHD
			Oct 11, 06	.....	.....	14.2, 15.4	74 36.4 N	.....	.....	..	172.12	PHD
Goderich	43 46.1 N	278 18	Sep 30, 06	10.0, 11.8	4 18.3 W	.....	.....	10.5, 11.2	.16586	20	.....	PHD
			Sep 28, 06	.....	.....	17.4	74 27.0 N	.....	.....	..	172.12	PHD
Berlin	43 27.1 N	279 29	Oct 4, 06	10.8, 12.6	5 29.0 W	13.7	74 23.8 N	11.3, 12.1	.16646	20	172.12	PHD
Hyde Park Junction	42 59.2 N	278 41	Oct 1, 06	13.0, 14.6	3 29.7 W	10.9	73 57.1 N	13.4, 14.1	.17025	20	172.12	PHD
Simcoe	42 51.0 N	279 42	Oct 3, 06	11.3, 13.0	4 42.2 W	14.1	74 05.1 N	11.7, 12.5	.16999	20	172.12	PHD
Chatham	42 23.6 N	277 50	Oct 2, 06	10.1	2 11.4 W	12.3	73 34.0 N	10.6, 11.2	.17471	20	172.12	PHD

CENTRAL AMERICA.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Belize	17 30.2 N	271 49	Mar 5,'07	12.6, 13.8	5 13.9 E	7.8	44 41.3 N	13.0, 13.4	.32650	20	177.1256	JAF
			Feb 11, 09	16.0, 18.0	5 06.8 E	.....	.....	16.7, 17.6	.32710	7	172.12	WHS
			Feb 12, 09	.....	.....	9.2	44 47.5 N	10.0	*.32725*	*172*	.....	WHS
El Cayo	17 10.4 N	270 55	Feb 19, 09	9.2, 11.4	5 52.5 E	13.9	44 09.8 N	9.9, 10.8	.32550	7	172.12	WHS
			Feb 19, 09	.....	.....	.....	.....	15.0	*.32505*	*172*	.....	WHS
			Mar 10, 09	9.7, 11.6	5 56.9 E	12.8	44 06.4 N	10.2, 11.0	.32540	7	172.12	WHS
Yaxja	17 04.5 N	270 38	Feb 24, 09	9.7, 11.6	5 57.4 E	14.0	43 56.1 N	10.2, 11.1	.32574	7	172.12	WHS
			Feb 24, 09	.....	.....	.....	.....	15.0 (wt.½)	*.32530*	*172*	.....	WHS
Macanché	16 59.0 N	270 25	Feb 26, 09	.....	.....	16.1	43 45.1 N	16.8 (wt.½)	*.32590*	*172*	172.12	WHS
			Feb 27, 09	8.5, 10.4	5 53.6 E	.....	.....	9.0, 9.8	.32634	7	.....	WHS
Flores	16 56.2 N	270 04	Mar 1, 09	9.4, 11.3	6 03.2 E	13.7	43 40.3 N	9.9, 10.8	.32646	7	172.12	WHS
			Mar 1, 09	.....	.....	.....	.....	14.7 (wt.½)	*.32614*	*172*	.....	WHS
Trapp's Key	16 30.0 N	271 44	Mar 20, 09	13.6, 15.6	5 39.8 E	.....	.....	14.2, 15.1	.32543	7	.....	WHS
			Mar 21, 09	.....	.....	10.0	43 26.7 N	10.8 (wt.½)	*.32558*	*172*	172.12	WHS
Roatan	16 17.1 N	273 24	Apr 1, 09	12.9, 14.8	5 07.8 E	.....	.....	13.4, 14.2	.32564	7	.....	WHS
			Apr 2, 09	.....	.....	8.9	43 26.4 N	9.8 (wt.½)	*.32563*	*172*	172.12	WHS
New Haven	16 16.3 N	271 23	Mar 10, 07	16.4, 17.2	5 46.4 E	.....	.....	16.6, 17.0	.32775	20	.....	JAF
			Mar 11, 07	.....	.....	7.6	42 44.8 N	.....	.....	..	177.1256	JAF
Punta Gorda	16 05.7 N	271 09	Mar 8, 07	15.8, 16.8	5 43.7 E	13.8	42 27.8 N	16.1, 16.5	.32946	20	177.1256	JAF
Port Burchard	15 56.0 N	274 49	Apr 5, 09	13.0, 15.0	4 47.6 E	.....	.....	13.5, 14.4	.32448	7	.....	WHS
			Apr 6, 09	.....	.....	8.8	43 07.4 N	9.7 (wt.½)	*.32410*	*172*	172.12	WHS
Truxillo	15 55.4 N	274 02	Mar 28, 09	13.6, 15.6	4 54.0 E	.....	.....	14.2, 15.1	.32477	7	.....	WHS
			Mar 29, 09	.....	.....	9.0	42 54.2 N	9.9 (wt.½)	*.32548*	*172*	172.12	WHS
Puerto Cortez	15 50.7 N	272 02	Mar 12, 07	12.6, 13.6	5 39.4 E	15.6	42 28.6 N	12.9, 13.4	.32790	20	177.1256	JAF
Point Patuca	15 48.6 N	275 36	Apr 9, 09	14.8, 16.9	4 28.9 E	.....	.....	15.4, 16.4	.32391	7	.....	WHS
			Apr 10, 09	12.8, 15.2	4 28.4 E	9.8	43 07.6 N	13.4, 14.6	.32406	7	172.12	WHS
			Apr 10, 09	.....	.....	.....	.....	10.8 (wt.½)	*.32371*	*172*	.....	WHS
Puerto Barrios	15 45.3 N	271 24	Jul 5, 09	.....	.....	14.0	42 22.0 N	14.9 (wt.½)	*.32592*	*172*	172.12	WHS
			Jul 6, 09	8.5, 10.7	6 00.9 E	.....	.....	9.1, 10.1	.32690	7	.....	WHS
Laceiba	15 45 N	273 14	Mar 15, 07	16.8, 17.7	5 12.8 E	.....	.....	17.0, 17.4	.32769	20	.....	JAF
			Mar 16, 07	.....	.....	7.0	42 24.6 N	.....	.....	..	177.1256	JAF
Cobán	15 29 N	269 42	Mar 30, 07	15.4, 16.4	6 05.0 E	17.3	41 12.8 N	15.7, 16.1	.33112	20	177.1256	JAF
Tactic	15 20 N	269 45	Mar 29, 07	17.0, 18.1	6 16.2 E	18.3	40 53.1 N	17.2, 17.5	.33170	20	177.12	JAF
Huehuetenango	15 19.4 N	268 36	Apr 7, 07	9.4, 10.4	6 29.5 E	11.3	40 39.4 N	9.7, 10.1	.33184	20	177.1256	JAF
Salamá	15 05.6 N	269 46	Mar 28, 07	9.1, 10.4	6 11.8 E	13.3	40 30.6 N	9.5, 10.0	.33343	20	177.1256	JAF

NORTH AMERICA.

CENTRAL AMERICA—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Cabulco	15 05 N	269 28	Apr 2,'07	17.9	6 11.1 E	.....	.....	18.1	.33274	20	.....	JAF
			Apr 3, 07	.....	.....	6.5	40 27.5 N	.....	.....	..	177.1256	JAF
Chiche	15 04 N	269 02	Apr 4, 07	17.2, 18.0	5 57.6 E	.....	.....	17.4, 17.8	.33199	20	.....	JAF
			Apr 5, 07	.....	.....	6.6	40 14.2 N	.....	.....	..	177.1256	JAF
Zacapa	14 59.3 N	271 30	Mar 20, 07	9.2, 10.2	6 01.8 E	11.3	40 32.1 N	9.5, 10.0	.33248	20	177.1256	JAF
Cape Gracias	14 58.9 N	276 45	Apr 15, 09	9.1, 11.4, 11.6	4 32.7 E	13.4	42 19.4 N	9.6, 10.7	.32299	7	172.12	WHS
			Apr 15, 09	.....	.....	.....	.....	14.4 (wt.½)	*.32246*	*172*	.....	WHS
San Marcos	14 58 N	268 16	Apr 9, 07	16.1, 17.1	6 10.6 E	14.9	39 56.1 N	16.4, 16.8	.33116	20	177.1256	JAF
Guatemala City	14 37.9 N	269 30	Jul 2, 09	9.2, 11.1, 11.4	6 33.8 E	13.6	40 09.8 N	9.7, 10.6	.32942	7	172.12	WHS
			Jul 2, 09	.....	.....	.....	.....	14.6 (wt.½)	*.32887*	*172*	.....	WHS
Santa Rosita	14 36.9 N	269 34	Mar 24, 07	10.5, 11.4	6 15.3 E	13.2	39 56.3 N	10.7, 11.2	.33064	20	177.1256	JAF
San Felipe	14 35.1 N	268 26	Apr 12, 07	9.8, 10.9	6 08.2 E	13.1	40 04.0 N	10.0, 10.6	.33329	20	177.1256	JAF
Champerico	14 19 N	268 08	Apr 13, 07	16.9, 17.8	6 34.2 E	16.2	38 59.5 N	17.2, 17.5	.33652	20	177.1256	JAF
Tegucigalpa	14 03.5 N	272 47	Jun 3, 09	9.1	5 40.4 E	13.7	39 59.3 N	.....	.....	7	172.12	WHS
			Jun 3, 09	.....	.....	.....	.....	14.6 (wt.½)	*.32929*	*172*	.....	WHS
			Jun 4, 09	9.0, 11.0	5 37.2 E	.....	.....	9.5, 10.4	.32910	7	.....	WHS
San José (Guatemala)	13 55.0 N	269 13	Apr 15, 07	16.9, 17.8	6 29.6 E	.....	.....	17.1, 17.6	.33343	20	.....	JAF
			Apr 16, 07	.....	.....	6.5	39 07.0 N	.....	.....	..	177.1256	JAF
			Apr 23, 07	.....	.....	16.4	39 09.2 N	.....	.....	..	177.1256	JAF
			Jun 27, 09	9.3, 9.6, 11.4	6 40.3 E	7.3	39 06.4 N	10.1, 11.0	.33334	7	172.12	WHS
			Jun 27, 09	.....	.....	.....	.....	8.0 (wt.½)	*.33342*	*172*	.....	WHS
San Salvador	13 42.8 N	270 49	Jun 20, 09	.....	.....	14.3	38 07.5 N	15.2 (wt.½)	*.33261*	*172*	172.12	WHS
			Jun 21, 09	8.6, 10.6, 11.4	5 30.9 E	.....	.....	9.2, 10.1	.33329	7	.....	WHS
Perspire	13 35.1 N	272 39	Jun 8, 09	8.9, 10.9	6 27.6 E	13.8	38 50.7 N	9.4, 10.4	.33414	7	172.12	WHS
			Jun 8, 09	.....	.....	.....	.....	14.9 (wt.½)	*.33430*	*172*	.....	WHS
Acajutla	13 34 N	270 10	Jun 23, 09	9.0, 11.4	6 31.4 E	13.5	39 06.2 N	9.5, 10.6	.33248	7	172.12	WHS
			Jun 23, 09	.....	.....	.....	.....	14.6 (wt.½)	*.33233*	*172*	.....	WHS
Prinzapolca	13 22.2 N	276 21	Apr 17, 09	15.8, 17.6	4 44.6 E	.....	.....	16.3, 17.1	.32538	7	.....	WHS
			Apr 18, 09	.....	.....	9.6	39 57.6 N	10.4 (wt.½)	*.32569*	*172*	172.12	WHS
La Union	13 20.5 N	272 09	Jun 11, 09	.....	.....	15.1	37 18.4 N	15.9 (wt.½)	*.33224*	*172*	172.12	WHS
			Jun 12, 09	8.2, 10.3	5 27.6 E	.....	.....	8.8, 9.7	.33304	7	.....	WHS
Amapala	13 17.7 N	272 21	Jun 14, 09	.....	.....	14.3	37 12.9 N	15.1 (wt.½)	*.32936*	*172*	172.12	WHS
			Jun 15, 09	8.4, 10.4	5 09.1 E	.....	.....	8.9, 9.8	.32988	7	.....	WHS
Corinto	12 26.9 N	272 48	May 22, 09	.....	.....	13.5	37 23.4 N	14.4 (wt.½)	*.33148*	*172*	172.12	WHS
			May 23, 09	8.6, 10.4	6 18.8 E	.....	.....	9.1, 9.9	.33214	7	.....	WHS
Managua	12 09.6 N	273 42	May 6, 09	8.9, 11.0, 11.2	5 32.5 E	.....	.....	9.6, 10.5	.32968	7	.....	WHS
			May 6, 09	.....	.....	13.7	37 26.5 N	14.6 (wt.½)	*.32937*	*172*	172.12	WHS
			May 7, 09	8.9, 10.8	5 30.9 E	.....	.....	9.4, 10.3	.32984	7	.....	WHS
Bluefields	12 01.5 N	276 15	Apr 22, 09	14.8, 16.8	5 05.8 E	.....	.....	15.4, 16.3	.32661	7	.....	WHS
			Apr 23, 09	.....	.....	9.2	38 23.7 N	10.2 (wt.½)	*.32606*	*172*	172.12	WHS
Granada	11 54.0 N	274 03	May 9, 09	9.2, 11.3	5 52.9 E	13.7	37 02.1 N	9.8, 10.8	.33092	7	172.12	WHS
			May 9, 09	.....	.....	.....	.....	15.0 (wt.½)	*.33067*	*172*	.....	WHS
San Ubaldo	11 49.4 N	274 40	May 14, 09	.....	.....	14.4	37 20.8 N	.....	.....	..	172.12	WHS
			May 15, 09	8.2, 10.2	5 18.4 E	.....	.....	8.7, 9.7	.32718	7	.....	WHS
San Jorgé	11 28.3 N	274 14	May 11, 09	9.1, 11.2	5 43.4 E	13.4	36 13.8 N	9.7, 10.7	.33253	7	172.12	WHS
			May 11, 09	.....	.....	.....	.....	14.3 (wt.½)	*.33258*	*172*	.....	WHS
San Carlos	11 08.0 N	275 14	May 3, 09	.....	.....	13.7	37 05.4 N	14.6 (wt.½)	*.33003*	*172*	172.12	WHS
			May 4, 09	10.4, 12.9	4 58.0 E	.....	.....	11.2, 12.4	.33042	7	.....	WHS
Greytown	10 54.9 N	276 18	Apr 26, 09	.....	.....	13.6	35 52.4 N	14.6 (wt.½)	*.32948*	*172*	172.12	WHS
			Apr 27, 09	9.2, 11.2	5 11.6 E	.....	.....	9.8, 10.6	.33006	7	.....	WHS
Koschny	10 26.3 N	275 34	May 20, 07	15.4, 16.4	4 56.2 E	.....	.....	15.7, 16.2	.33154	20	.....	JAF
			May 21, 07	.....	.....	8.8	34 27.2 N	.....	.....	..	177.1256	JAF
Ballena	10 22.4 N	274 32	May 26, 07	8.9, 10.0	5 38.9 E	7.3	33 52.5 N	9.3, 9.7	.33150	20	177.1256	JAF
Sarchi	10 06 N	275 39	May 18, 07	17.5, 18.1	5 47.4 E	.....	.....	17.8	.33079	20	.....	JAF
			May 19, 07	.....	.....	6.3	34 23.8 N	.....	.....	..	177.1256	JAF
Uvita Island	9 59.9 N	277 00	May 14, 07	12.5, 13.6	4 53.6 E	14.5	34 11.8 N	12.8, 13.4	.33179	20	177.1256	JAF
Puntarenas	9 58 N	275 08	May 24, 07	15.8, 16.8	5 35.2 E	12.2	33 36.9 N	16.0, 16.5	.33078	20	177.1256	JAF
San José (Costa Rica)	9 57 N	275 56	May 17, 07	9.5, 10.6, 15.0	5 17.7 E	12.2	34 18.3 N	9.8, 10.3	.33288	20	177.1256	JAF
Colon, Quarantine Station	9 21.8 N	286 06	Apr 7, 09	10.4, 14.2	4 03.2 E	.....	.....	11.0, 12.6	.32682	9	.....	EK
			Apr 7, 09	.....	.....	.....	.....	13.3	.32666	9	.....	EK
			Apr 8, 09	.....	.....	9.8, 13.4	34 31.7 N	.....	.....	..	178.1256	EK
Colon Harbor	9 21.4 N	280 03	May 5, 07	12.6, 13.6	4 45.9 E	14.6	34 11.8 N	12.9, 13.4	.32670	20	177.1256	JAF
			Jul 20, 08	14.2, 15.9	4 47.0 E	12.7	34 30.4 N	14.7, 15.4	.32574	4	189.56	HWF
			Apr 14, 09	13.1	4 46.3 E	14.8	34 32.5 N	13.6	.32506	9	178.1	EK
Cristobal	9 21.4 N	280 03	Mar 14, 05	13.2, 14.8	4 32.2 E	10.8	33 50.6 N	13.8, 14.4	.32807	19	171.12	JPA
			Mar 30, 05	7.6 to 17.2 (d.v.)	4 29.4 E	.....	.....	.....	.....	19	.....	JPA
			Jun 15, 07	15.0, 15.9	4 28.3 E	16.6	34 13.4 N	15.3, 15.7	.32756	20	177.1256	JAF

NORTH AMERICA.

CENTRAL AMERICA—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Bocas del Toro	9 21 N	276 47	May 8,'07	9.3, 10.3	4 53.4 E	11.4	33 07.8 N	9.6, 10.1	.33155	20	177.1256	JAF
Punta Dominical	9 12.6 N	277 09	May 31, 07	9.0, 10.0	5 35.8 E	10.9	32 40.7 N	9.3, 9.7	.33396	20	177.1256	JAF
Flamenco Island	8 54.5 N	280 30	May 3, 07	9.6, 10.7	4 48.6 E	11.8	33 20.6 N	10.0, 10.4	.32754	20	177.1256	JAF
			Apr 19, 09	13.1, 15.5	4 46.0 E	.....	.....	13.7, 14.8	.32584	9	.....	EK
			Apr 20, 09	13.3	4 47.0 E	10.5, 11.6	33 50.1 N	14.0	.32579	9	178.1256	EK
Golfo Dulce	8 31.5 N	276 41	Jun 2, 07	12.6, 13.6	5 18.6 E	10.7	31 49.4 N	12.9, 13.3	.33228	20	177.1256	JAF
David	8 26.0 N	277 33	Jun 5, 07	15.3, 16.4	5 07.4 E	13.4	32 24.5 N	15.6, 16.1	.33146	20	177.1256	JAF
			Jun 6, 07	8.8, 9.8	5 05.6 E	7.8, 11.0	32 24.0 N	9.1, 9.6	.33175	20	177.1256	JAF
			Jun 6, 07	.....	.....	17.0	32 26.4 N	.....	.....	..	177.1256	JAF
			Jun 7, 07	16.9, 17.6	5 07.6 E	.....	.....	17.1, 17.4	.33128	20	.....	JAF
Barranca Colorado	7 56 N	278 41	Jun 12, 07	7.2, 8.3	4 53.5 E	9.6	31 43.3 N	7.4, 8.0	.33120	20	177.1256	JAF

GREENLAND.

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Etah, Auxiliary	78 18.5 N	287 20	Aug 20,'08	.....	.....	.....	.....	9.6, 10.7	.04079	1	.....	CCC
Etah	78 18.2 N	287 20	Aug 12, 08	.....	.....	.....	.....	10.0	.03909	2	.....	CCC
			Aug 12, 08	13.4 to	104 04.2W	.....	.....	.....	.....	1	.....	CCC
			Aug 13, 08	11.5 (d. v.)								
			Aug 14, 08	.....	.....	13.4, 15.6	85 58.4 N	14.1, 14.9	*.04010*	*35*	35.12	CCC
			Aug 16, 08	9.9 to 14.9 (d.v.)	104 28.8 W	.....	.....	.....	.....	1	.....	CCC
Kangerdlooksoah	77 23 N	292 56	Aug 7, 08	17.3 to								
			Aug 8, 08	14.7 (d. v.)	92 07.9 W	.....	.....	15.9, 16.9	.04805	1	.....	CCC
			Aug 8, 08	16.8 to 17.8 (d.v.)								
			Aug 9, 08	.....	.....	9.4, 12.6	85 25.0 N	10.4, 11.8	*.04541*	*35*	35.12	CCC
North Star Bay	76 32.9 N	291 11	Aug 1, 08	.....	.....	19.1, 22.1	85 14.6 N	20.1, 21.2	*.04711*	*35*	35.12	CCC
			Aug 2, 08	7.7 to 11.7 (d.v.)	89 55.1 W	.....	.....	3.2, 4.4	.04706	1	.....	CCC
			Aug 2, 08	13.5 to 14.9 (d.v.)								
			Aug 3, 08	11.0 to 13.7 (d.v.)	90 35.2 W	.....	.....	.....	.....	1	.....	CCC
			Aug 3, 08	15.6 to 24.0 (d.v.)								
			Aug 4, 08	0.0 to 7.9 (d.v.)	89 37.3 W	.....	.....	.....	.....	1	.....	CCC
			Aug 4, 08	14.5 to 15.6 (d.v.)								
Cape York	75 54 N	293 34	Aug 23, 08	9.6, 11.2	79 18.6 W	12.4, 14.3	84 29.4 N	10.2, 10.9	.05630	1	35.12	CCC
			Aug 23, 08	11.8	79 27.1 W	.....	.....	13.0, 13.7	*.05636*	*35*	.....	CCC
Upernavik	72 46.8 N	303 49	Aug 26, 08	12.7, 14.4	69 30.0 W	16.2, 18.2	83 23.4 N	13.2, 14.0	.06668	1	35.12	CCC
			Aug 26, 08	15.6	69 36.1 W	.....	.....	16.8, 17.6	*.06650*	*35*	.....	CCC
Hare Island	70 28.5 N	304 59	Aug 28, 08	9.2, 10.7	63 15.3 W	11.6, 13.3	81 07.9 N	9.6, 10.4	.08840	1	35.12	CCC
			Aug 28, 08	.....	.....	.....	.....	12.1, 12.7	*.08791*	*35*	.....	CCC
Godhavn	69 14.1 N	306 28	Aug 29, 08	9.7, 11.4	62 32.2 W	12.2, 14.5	81 49.5 N	10.2, 11.0	.08219	1	35.12	CCC
			Aug 29, 08	.....	.....	.....	.....	12.8, 13.9	*.08138*	*35*	.....	CCC
Holsteenborg	66 56 N	306 19	Sep 3, 08	8.7, 10.7	61 20.4 W	11.8, 14.0	81 31.8 N	9.5, 10.2	.08362	1	35.12	CCC
			Sep 3, 08	12.9	61 35.4 W	.....	.....	12.4, 13.4	*.08334*	*35*	.....	CCC

MEXICO.

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Nueva Casas Grandes	30 25.3 N	252 05	Dec 6,'06	13.4, 14.6	11 51.4 E	10.0	57 25.0 N	13.8, 14.3	.28518	20	177.56	JPA
			Dec 7, 06	.....	.....	9.6	57 23.0 N	.....	.....	..	177.12	JPA
Hermosillo	29 04.4 N	249 04	Nov 29, 06	11.3, 14.2, 14.6	11 58.3 E	12.4, 13.3	55 26.6 N	12.9, 13.7	*.29236*	*178*	178.1256	DCS
Temosachic	28 58.8 N	252 09	Dec 13, 06	9.9, 11.1	11 25.0 E	12.8	55 50.6 N	10.2, 10.8	.29242	20	177.56	JPA
Chihuahua, B	28 38.7 N	253 54	Dec 17, 06	9.9, 11.2	12 12.8 E	13.1	55 57.6 N	10.4, 11.0	.29170	20	177.56	JPA
Chihuahua, A	28 37.5 N	253 54	Dec 11, 06	12.6, 13.7	13 28.4 E	10.2	54 27.4 N	12 9, 13.4	.29920	20	177.56	JPA
Guaymas	27 54.5 N	249 09	Nov 27, 06	15.9	12 18.6 E	16.3	53 49.0 N	16.6 ...	*.29875*	*178*	178.12	DCS
			Nov 28, 06	9.0, 11.0	12 22.4 E	9.8, 10.7	53 50.6 N	9.4, 10.2	*.29904*	*178*	178.1256	DCS
Sabinas	27 52.7 N	258 55	Jan 3, 07	10.1, 11.2	9 47.8 E	13.3	55 59.5 N	10.4, 10.9	.29303	20	177.1256	JPA
Sierra Mojada	27 18.9 N	256 23	Dec 24, 06	13.1, 14.1	10 01.2 E	15.4	54 40.2 N	13.4, 13.9	.29872	20	177.12	JPA
			Dec 25, 06	.....	.....	9.0	54 38.6 N	.....	.....	..	177.56	JPA
Jimenez	27 09.2 N	255 06	Dec 19, 06	12.8, 13.9	10 24.8 E	10.9	54 13.3 N	13.2, 13.7	.29944	20	177.56	JPA
Cuatro Cienegas	26 59.6 N	257 56	Jan 1, 07	12.8, 13.9	9 42.4 E	15.1	54 38.4 N	13.1, 13.6	.29914	20	177.56	JPA
Santa Barbara	26 49.1 N	254 13	Dec 21, 06	12.6, 13.9	10 35.4 E	9.1	53 48.9 N	13.0, 13.6	.30087	20	177.56	JPA
Escalon	26 44.5 N	255 41	Dec 22, 06	13.2, 14.4	10 04.4 E	15.8	53 53.4 N	13.5, 14.1	.30131	20	177.56	JPA
Camargo	26 15.7 N	261 09	Jan 15, 07	10.1, 11.5	8 41.0 E	13.1	54 24.5 N	10.6, 11.2	.30104	20	177.56	JPA
San Pedro	25 45.9 N	257 01	Dec 28, 06	12.4, 13.3	9 42.5 E	10.8	53 02.0 N	12.7, 13.1	.30570	20	177.56	JPA
Monterey, A	25 40.5 N	259 41	Jan 7, 07	.....	.....	14.8	53 21.4 N	.....	.....	..	177.56	JPA
			Jan 8, 07	10.8, 15.1, 15.5	9 01.0 E	.....	.....	10.0, 10.5	.30466	20	.....	JPA
			Jan 11, 07	10.5, 11.6	9 01.4 E	9.3	53 20.6 N	10.8, 11.4	.30414	20	177.12	JPA

NORTH AMERICA.

MEXICO—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Monterey, B	25 40.5 N	259 41	Jan 7,'07	.....	.....	15.8	53 21.9 N	.....	.....	..	177.56	JPA
			Jan 9, 07	9.1, 10.2	9 03.9 E	.....	.....	9.4, 9.9	.30446	20	.....	JPA
Cuajimalpa, A	19 22.4 N	260 43	Jan 26, 07	15.0	7 45.9 E	11.5	44 58.2 N	12.9, 13.4	.32906	20	177.56	JPA
			Jan 28, 07	13.4, 13.6	7 45.4 E	.....	.....	12.0, 12.6	.32936	20	.....	JPA
			Jan 30, 07	12.6, 15.8, 16.0	7 45.7 E	10.7	45 01.6 N	12.9, 13.4	.32961	20	177.12	JPA
Cuajimalpa, B	19 22.4 N	260 43	Jan 28, 07	.....	.....	10.8	45 03.4 N	.....	.....	..	177.56	JPA
Oaxaca	17 03.6 N	263 15	Jan 22, 07	10.3, 11.6	7 20.6 E	13.5	42 20.3 N	10.7, 11.3	.33102	20	177.56	JPA
			Jan 23, 07	.....	.....	10.6	42 20.9 N	.....	.....	..	177.12	JPA

NEWFOUNDLAND (INCLUDING LABRADOR).

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
West Turnavik	55 14.6 N	300 40	Aug 23,'05	6.0 to 13.0 (d.v.)	37 51.3 W	.....	.....	.....	.....	68	.....	GLH
			Aug 24, 05	4.0 to 16.0 (d.v.)	37 53.4 W	.....	.....	.....	.....	68	.....	GLH
			Aug 25, 05	4.0 to 16.0 (d.v.)	37 48.5 W	.....	.....	.....	.....	68	.....	GLH
			Aug 26, 05	4.0 to 16.0 (d.v.)	37 49.4 W	.....	.....	.....	.....	68	.....	GLH
			Aug 28, 05	4.0 to 16.0 (d.v.)	37 49.3 W	.....	.....	.....	.....	68	.....	GLH
			Aug 29, 05	4.0 to 10.0 (d.v.)	37 51.4 W	.....	.....	.....	.....	68	.....	GLH
			Aug 30, 05	3.0 to 10.0 (d.v.)	37 43.8 W	.....	.....	.....	.....	68	.....	GLH
			Sep 2, 05	2.0 to 14.0 (d.v.)	37 51.4 W	.....	.....	.....	.....	68	.....	GLH
			Sep 4, 05	2.0 to 14.0 (d.v.)	37 47.6 W	.....	.....	.....	.....	68	.....	GLH
			Sep 5, 05	.....	.....	16.5	79 15.2 N	9.7, 11.0	.10935	68	122.12	GLH
			Sep 5, 05	.....	.....	.....	.....	14.2, 14.7	.10950	68	.....	GLH
			Sep 6, 05	.....	.....	14.6	79 17.8 N	9.4, 10.5	.10934	68	122.12	GLH
			Sep 6, 05	.....	.....	.....	.....	15.5	*.10883*	*122*	.....	GLH
			Sep 7, 05	.....	.....	.....	.....	8.6	*.10930*	*122*	.....	GLH
			Sep 23, 08	9.7, 11.6	38 01.2 W	.....	.....	10.4, 11.2	.11028	1	.....	CCC
			Sep 23, 08	12.7, 14.7	38 02.2 W	13.3	79 11.7 N	13.8, 14.2	*.11037*	*35*	35.12	CCC
West Turnavik, Auxiliary	55 15 N	300 38	Sep 24, 08	9.2, 10.9	36 42.8 W	12.0	78 49.6 N	9.7, 10.4	.11357	1	35.12	CCC
			Sep 24, 08	11.5	36 36.7 W	.....	.....	12.6	*.11324*	*35*	.....	CCC
Hawk Harbor	53 02.2 N	304 12	Jul 20, 08	9.2, 11.2	39 57.0 W	.....	.....	9.8, 10.7	.12590	1	.....	CCC
			Jul 20, 08	12.8	39 56.4 W	13.5, 16.2	77 09.8 N	14.3, 15.5	*.12642*	*35*	35.12	CCC
Battle Harbor, A	52 16.4 N	304 25	Aug 15, 05	11.7, 15.0	35 27.3 W	11.5	76 32.4 N	.....	.....	*172*	172.12	B,B,H
Battle Harbor, B	52 16.4 N	304 25	Aug 15, 05	16.5, 18.3	35 22.1 W	16.1	76 29.2 N	.....	.....	*172*	172.12	B,B,H
Battle Harbor, Bm	52 16.4 N	304 25	Aug 22 to Sep 14, 05	Mag'gram value mean of 16 days	.....	.....	.....	.....	.13419	7041 & 1*	.....	B,B,H
			Aug 23, 05	.....	.....	17.3	76 25.5 N	.....	.....	...	172.12	B,B,H
			Aug 25, 05	.....	.....	16.2	76 24.6 N	.....	.....	...	172.12	B,B,H
Battle Harbor, C	52 16.4 N	304 25	Aug 22 to Sep 14, 05	Mag'gram value mean of 16 days	35 05.8 W	.....	.....	.....	.13419	7041 & 1*	.....	B,B,H
			Aug 29, 05	.....	.....	15.4, 16.1	76 21.5 N	.....	.....	...	172.12	B,B,H
			Sep 1, 05	.....	.....	14.0, 14.7	76 20.6 N	.....	.....	...	172.12	B,B,H
			Sep 5, 05	.....	.....	15.6, 16.7	76 19.9 N	.....	.....	...	172.12	B,B,H
			Sep 11, 05	.....	.....	16.9	76 20.2 N	.....	.....	...	172.12	B,B,H
Seldom-come-by Harbor	49 36 N	305 49	Sep 28, 08	13.6, 15.6	32 27.0 W	14.1	75 18.5 N	15.1	*.14436*	*35*	35.12	CCC
Norris Arm	49 05.9 N	304 44	Aug 15, 09	13.7, 15.3	31 07.8 W	11.4	74 37.7 N	14.5	.15067	4	201.12	EK
Millertown Junction	49 00.4 N	303 39	Aug 14, 09	9.2, 11.3	30 50.4 W	13.2	75 07.8 N	9.7, 10.7	.14714	4	201.12	EK
			Sep 1, 09	.....	.....	14.4	75 08.1 N	16.4	.14729	4	201.12	EK
Bay of Islands	48 57 N	302 00	Sep 20, 05	10.0, 11.4	30 22.6 W	11.0	75 22.6 N	.....	.....	*172*	172.12	JEB
			Aug 13, 09	9.8, 11.1	30 31.4 W	13.3	75 12.6 N	10.2	.14717	4	201.12	EK
Gambo	48 46.3 N	305 46	Aug 16, 09	14.2, 16.4	30 54.2 W	.....	.....	14.7, 15.8	.15176	4	.....	EK
			Aug 17, 09	12.5	31 01.9 W	11.4	74 34.5 N	.....	.....	4	201.12	EK
St. Georges	48 26 N	301 30	Aug 10, 09	10.4, 13.2	30 18.0 W	16.2	75 40.2 N	11.1, 12.5	.14393	4	201.12	EK
Clarenville	48 09.9 N	306 01	Aug 18, 09	10.9, 14.6	30 34.4 W	16.5	73 54.4 N	11.4, 14.1	.15540	4	201.12	EK
Carbonear	47 42.9 N	306 46	Sep 5, 09	14.0, 15.9	29 59.9 W	10.9	73 48.2 N	14.6, 15.4	.15721	4	201.12	EK
Beachy Cove	47 38 N	307 09	Sep 24, 09	10.4, 12.8	29 04.4 W	12.0	73 38.7 N	12.0	*.15834*	*201*	201.12	EK
St. John's	47 34.4 N	307 16	Aug 11, 05	15.0, 16.6	29 38.8 W	11.8	73 33.2 N	.....	.....	68	122.12	GLH
			Aug 12, 05	14.4	29 41.2 W	.....	.....	12.8, 13.8	.15832	68	.....	GLH
St. John's, A	47 34.4 N	307 16	Aug 21, 09	10.4, 12.6	29 47.0 W	15.8	73 27.1 N	11.0, 12.0	.15890	4	201.12	EK
			Aug 23, 09	9.7, 14.0	29 46.2 W	12.0	73 29.4 N	10.2, 13.5	.15902	4	201.12	EK
			Aug 24, 09	15.2, 16.0, 16.6	29 46.3 W	.....	.....	.....	.....	4	.....	EK
			Aug 25, 09	15.4, 16.1, 16.8	29 44.8 W	11.8	73 29.6 N	10.4, 12.9	.15902	4	201.12	EK
			Aug 26, 09	15.6, 16.3, 17.0	29 43.9 W	.....	.....	.....	.....	4	.....	EK
			Aug 28, 09	.....	.....	16.3	73 27.0 N	14.9, 17.3	.15960	4	201.12	EK
			Aug 30, 09	.....	.....	11.5, 15.7	73 28.5 N	10.2, 12.6	.15902	4	201.12	EK

* Magnetograph No. 1.

NORTH AMERICA.

NEWFOUNDLAND (INCLUDING LABRADOR)—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
St. John's, A	47 34.4 N	307 16	Aug 30,'09	.....	.....	.....	.....	14.5, 17.0	.15939	4	.....	EK
			Sep 15, 09	.....	.....	13.1	73 28.2 N	.....	.....	..	201.12	EK
			Sep 17, 09	15.2	29 49.3 W	.....	.....	15.6	.15948	4	.....	EK
			Sep 18, 09	10.5	29 45.4 W	.....	.....	11.4	.15884	4	.....	EK
St. John's, B	47 34.4 N	307 16	Sep 14, 09	14.9, 16.8	29 44.9 W	12.3	73 28.1 N	15.5, 16.4	.15934	4	201.12	EK
St. John's, C	47 34.4 N	307 16	Sep 15, 09	14.8, 16.8	29 45.0 W	12.1	73 30.3 N	15.4, 16.4	.15916	4	201.12	EK
			Sep 18, 09	16.0	29 46.5 W	.....	.....	.....	.....	4	.....	EK
			Sep 20, 09	9.8	29 42.4 W	.....	.....	10.5	.15884	4	.....	EK
St. John's, D	47 34.4 N	307 16	Sep 16, 09	15.0, 17.1	29 48.5 W	11.3	73 30.4 N	15.4, 16.6	.15912	4	201.12	EK
			Sep 17, 09	10.2, 12.3	29 48.4 W	.....	.....	10.8, 11.8	.15895	4	.....	EK
The Narrows, (St. John's) North Head	47 34 N	307 20	Sep 21, 09	11.3, 13.0	29 48.8 W	12.2	73 32.2 N	12.2	*.16083*	*201*	201.12	EK
The Narrows, (St. John's) South Head	47 34 N	307 20	Sep 21, 09	16.6, 17.7	29 37.0 W	17.2	73 27.1 N	17.2	*.15999*	*201*	201.12	EK
Brigus	47 33 N	306 47	Sep 30, 08	15.4	29 38.2 W	15.7	73 47.4 N	.....	.....	*35*	35.12	CCC
Cape Spear	47 32 N	307 23	Sep 23, 09	14.3, 15.6	29 47.2 W	15.0	73 31.2 N	15.0	*.15907*	*201*	201.1	EK
Placentia Junction	47 24 N	306 22	Aug 19, 09	10.8	29 46.4 W	13.0	73 38.7 N	11.4	.15787	4	201.12	EK
Placentia	47 15.3 N	306 02	Sep 10, 09	9.9	29 49.4 W	14.4	73 47.2 N	10.1, 11.4	.15830	4	201.12	EK
			Sep 10, 09	14.0	29 47.0 W	.....	.....	.....	.....	*201*	.....	EK

UNITED STATES.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Juneau Hill*	58 18.2 N	225 36	Aug 19,'07	.....	.....	18.9	74 55 N	18.4	.15449	21	24.12	LAB
Juneau School*	58 18.0 N	225 35	Aug 22, 07	9.9, 10.8	32 15.5 E	11.9	75 30.6 N	10.4	.14677	21	24.12	LAB
Juneau Island*	58 16.4 N	225 37	Aug 21, 07	.....	.....	14.9	75 27.0 N	16.2	.14810	21	24.12	LAB
Sitka, Absolute Obs'y	57 03.0 N	224 40	Jul 22, 07	14.0, 15.3	29 58.2 E	16.2, 17.1	74 37.0 N	14.4, 15.0	.15546	1	178.12	G III
			Jul 23, 07	9.3, 10.6	30 09.0 E	11.4	74 40.5 N	9.7, 10.3	.15524	1	178.12	G III
			Jul 23, 07	.....	.....	15.2, 16.6	74 40.4 N	.....	.....	..	35.12	G III
			Jul 24, 07	.....	.....	9.9, 11.1	74 40.9 N	.....	.....	..	35.12	G III
			Jul 24, 07	.....	.....	15.4	74 40.6 N	.....	.....	..	169.12	G III
			Jul 25, 07	.....	.....	14.4, 16.1	74 40.1 N	.....	.....	..	169.12	G III
			Jul 29, 07	16.1	30 06.4 E	.....	.....	16.6, 17.3	.15520	4	.....	G III
			Jul 30, 07	9.4, 11.1	30 11.8 E	.....	.....	9.9, 10.6	.15529	4	.....	G III
			Jul 30, 07	15.6, 17.2	30 02.7 E	.....	.....	16.0, 16.7	.15516	4	.....	G III
			Jul 31, 07	.....	.....	11.8	74 37.9 N	.....	.....	..	189.56	G III
			Aug 1, 07	.....	.....	9.7, 10.9	74 37.5 N	.....	.....	..	189.56	G III
			Aug 1, 07	.....	.....	14.6, 16.4	74 39.6 N	.....	.....	..	189.56	G III
			Aug 2, 07	.....	.....	10.5	74 37.4 N	.....	.....	..	189.56	G III
			Aug 6, 07	14.0, 15.9	30 06.2 E	.....	.....	14.6, 15.4	.15534	1	.....	JCP
			Aug 7, 07	10.1, 11.7	30 17.5 E	.....	.....	10.5, 11.3	.15521	1	.....	JCP
			Aug 8, 07	.....	.....	14.6	74 39.5 N	.....	.....	..	35.12	JCP
Sitka, Auxiliary Obs'y	57 03.0 N	224 40	Jul 24, 07	14.6	30 01.6 E	.....	.....	15.0, 15.7	.15566	1	.....	G III
			Jul 25, 07	9.2, 10.6, 11.7	30 08.4 E	11.2	74 36.2 N	9.6, 10.3	.15562	1	178.12	G III
			Jul 26, 07	.....	.....	16.6, 17.5	74 37.1 N	.....	.....	..	178.12	G III
			Jul 29, 07	13.5, 15.4	30 04.2 E	.....	.....	14.0, 14.9	.15546	4	.....	G III
			Jul 30, 07	13.4, 15.0	30 02.6 E	.....	.....	13.8, 14.6	.15547	4	.....	G III
			Jul 31, 07	8.6, 10.3	30 13.7 E	.....	.....	9.0, 9.9	.15576	4	.....	G III
			Jul 31, 07	13.4, 14.8	30 03.2 E	.....	.....	11.0, 11.6	.15552	4	.....	G III
			Jul 31, 07	.....	.....	.....	.....	13.8, 14.4	.15564	4	.....	G III
			Aug 5, 07	10.8, 15.6	30 03.8 E	.....	.....	12.6, 14.7	.15550	1	.....	JCP
			Aug 5, 07	.....	.....	.....	.....	15.8	.15571	1	.....	JCP
			Aug 6, 07	12.1, 13.9, 16.0	30 03.0 E	17.0	74 35.2 N	15.4	.15503	21	24.12	LAB
			Aug 8, 07	12.5, 14.0	30 02.8 E	15.1	74 36.2 N	14.0	.15502	21	24.12	LAB
Kutkan Island	57 02 N	224 40	Jul 26, 07	14.6, 16.0	30 16.4 E	.....	.....	15.0, 15.7	.15676	1	.....	G III
			Jul 23, 07	.....	.....	15.4	74 30.0 N	.....	.....	..	178.12	G III
Pembina	48 58.0 N	262 45	Sep 29, 06	16.6	11 25.1 E	17.2 (wt.4)	77 17.5 N	.....	.....	*177*	177.56	EHB
			Sep 30, 06	6.6, 7.8	11 29.7 E	7.2	77 15.7 N	7.2	*.13950*	*177*	177.7	EHB
Sault Ste. Marie	46 29.6 N	275 36	Oct 8, 06	6.7, 12.7	2 32.0 W	7.2, 13.2	76 53.3 N	13.2	*.14313*	*177*	177.567	EHB
Calais	45 10.9 N	292 43	Sep 14, 06	15.6, 16.6	17 58.2 W	14.7	74 42.2 N	16.1	.15796	21	24.12	LAB
Eastport, B	44 54.9 N	293 00	Sep 5, 06	11.2, 13.7, 16.8	19 43.3 W	14.8	74 20.5 N	15.2, 16.2	*.16184*	*177*	177.3567	EHB
Eastport, A	44 54.8 N	293 01	Sep 4, 06	12.5, 15.7	19 26.6 W	13.6	74 23.9 N	14.5	*.16140*	*177*	177.356	EHB
			Sep 5, 06	10.8	19 23.7 W	.....	.....	.....	.....	*177*	.....	EHB
Middlebury	44 00.9 N	286 49	Jul 27, 10	14.9, 17.7	12 52.6 W	.....	.....	15.7, 17.1	.16137	10	.....	PNS
			Jul 28, 10	14.4, 17.6	12 52.5 W	16.2	74 26 9 N	16.2(wt.½)	*.16155*	*178*	178.(567)	PNS

*Local disturbance.

NORTH AMERICA.

UNITED STATES—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h b	° ′	h b	Γ			
Newburyport	42 48.1 N	289 11	Nov 2,'05	15.1	13 20.3 W	.....	.....	.....	.....	68	.....	GLH
			Nov 3, 05	8.3, 10.4	13 20.2 W	14.4	73 34.4 N	8.9, 9.8	.16900	68	172.12	GLH
			Nov 3, 05	.....	.....	.....	.....	10.8, 11.8	.16909	68	.....	GLH
Swampscott, A	42 28.2 N	289 05	Sep 10, 06	10.7, 11.5	12 00.8 W	12.2	72 40.4 N	11.1	.18135	21	24.12	LAB
Swampscott, B	42 28.0 N	289 06	Sep 10, 06	8.2	13 04.4 W	7.4	72 28.8 N	8.4	.18547	21	24.12	LAB
Plum Island	41 10 N	287 48	Jul 29, 10	12.0, 13.2, 15.7	11 52.6 W	14.8	72 09.4 N	12.6	.18231	12	206.123	LAB
			Jul 29, 10	.....	.....	.....	.....	14.9	*.18255*	*206*	.....	LAB
Long Beach	41 07.1 N	287 43	Jun 24, 09	15.9, 17.5	11 12.8 W	12.0	72 09.6 N	16.3, 17.2	.18320	4	201.12	JPA
Greenport, A	41 06.4 N	287 38	Jun 28, 09	10.1, 11.6	10 50.2 W	8.9	72 06.2 N	10.5, 11.2	.18320	4	201.12	JPA
			Jun 10, 10	.....	.....	9.9, 10.5	72 07.6 N	.....	.....	..	201.12	C II
			Jun 10, 10	.....	.....	11.1	72 07.8 N	.....	.....	..	201.12	C II
			Jun 11, 10	12.9, 13.1, 14.9	11 00.1 W	.....	.....	13.7, 14.4	.18314	4	.....	C II
			Jun 11, 10	15.2, 15.6, 15.8	10 58.0 W	.....	.....	16.4, 17.0	.18327	4	.....	C II
			Jun 14, 10	14.4, 16.4, 17.7	.....	.....	.....	14.9, 15.7	.18323	4	.....	C II
			Jun 14, 10	.....	10 57.1 W	.....	.....	17.0	.18321	4	.....	C II
			Jun 15, 10	9.6, 11.4, 12.7	10 59.3 W	.....	.....	10.1, 10.9	.18287	4	.....	C II
			Jun 15, 10	.....	.....	.....	.....	11.8	.18299	4	.....	C II
			Jun 16, 10	.....	.....	10.1, 10.6	72 06.9 N	.....	.....	..	201.12	C II
			Jun 16, 10	.....	.....	11.7	72 05.8 N	.....	.....	..	201.12	C II
Greenport, B	41 06.4 N	287 38	Jun 10, 10	12.9, 13.3, 15.4	11 03.1 W	.....	.....	13.9, 14.8	.18342	4	.....	C II
			Jun 10, 10	15.6, 16.1, 16.4	11 02.6 W	.....	.....	16.8, 17.5	.18334	4	.....	C II
			Jun 11, 10	.....	.....	10.0, 10.7	72 07.0 N	.....	.....	..	201.12	C II
			Jun 11, 10	.....	.....	11.2	72 07.1 N	.....	.....	..	201.12	C II
			Jun 13, 10	15.0, 16.6	11 00.6 W	.....	.....	15.5, 16.2	.18347	4	.....	C II
			Jun 13, 10	.....	.....	.....	.....	17.3, 18.1	.18341	4	.....	C II
			Jun 14, 10	9.7, 10.8, 11.7	10 59.0 W	.....	.....	10.2, 11.3	.18306	4	.....	C II
			Jun 17, 10	.....	.....	10.0, 10.9	72 06.8 N	.....	.....	..	201.12	C II
			Jun 17, 10	.....	.....	12.6	72 04.8 N	.....	.....	..	201.12	C II
Gardiner's Island	41 05.8 N	287 52	Jun 26, 09	13.3, 14.6	11 11.0 W	11.2	72 09.0 N	13.6, 14.3	.18211	4	201.12	JPA
Shelter Island Heights, A	41 05 N	287 39	Aug 5, 10	10.9	11 18.0 W	11.7	72 13.3 N	11.7	*.18198*	*206*	206.123	LAB
Derring Harbor	41 05 N	287 39	Aug 20, 10	11.4, 12.6	11 26.7 W	14.3	72 14.6 N	12.0	.18165	12	206.123	LAB
			Aug 20, 10	.....	.....	.....	.....	14.3	*.18200*	*206*	.....	LAB
Ram Head	41 04 N	287 43	Aug 3, 10	12.1, 13.1	11 42.6 W	14.9	72 04.7 N	12.5	.18262	12	206.123	LAB
			Aug 3, 10	.....	.....	.....	.....	14.9	*.18295*	*206*	.....	LAB
Sammy's Beach	41 01.3 N	287 48	Jun 25, 09	13.5, 15.2	11 06.6 W	11.1	72 04.7 N	14.0, 14.8	.18270	4	201.12	JPA
New York, Bronx Park, A*	40 51.7 N	286 07	Jul 14, 09	13.3, 14.7	10 12.4 W	12.0	72 02.5 N	13.7, 14.4	.18552	4	201.12	JPA
			Jul 26, 09	15.0, 19.4	10 08.0 W	.....	.....	.....	.....	4	.....	JPA
			Feb 25, 10	.....	.....	15.6	72 07.9 N	.....	.....	..	201.12	C I
			Feb 26, 10	.....	.....	12.5, 14.7	72 05.8 N	.....	.....	..	201.12	C I
			Feb 28, 10	.....	.....	.....	.....	12.3, 14.2	.18516	2	.....	C I
			Feb 28, 10	.....	.....	.....	.....	15.0, 15.7	.18514	2	.....	C I
			Mar 1, 10	.....	.....	.....	.....	11.0, 11.7	.18496	4	.....	C I
			Mar 1, 10	.....	.....	.....	.....	13.9, 14.4	.18509	4	.....	C I
			Mar 3, 10	.....	.....	.....	.....	11.3, 12.0	.18513	4	.....	C I
			Mar 3, 10	.....	.....	.....	.....	14.4, 15.3	.18520	2	.....	C I
			Mar 4, 10	11.0 to 12.3(6)	10 11.8 W	.....	.....	.....	.....	2	.....	C I
			Mar 4, 10	13.7 to 15.4(7)	10 16.6 W	.....	.....	.....	.....	4	.....	C I
			Mar 10, 10	13.7, 14.3	10 16.7 W	.....	.....	.....	.....	4	.....	C I
			Mar 12, 10	.....	.....	10.5	72 06.2 N	.....	.....	..	201.12	C I
New York, Bronx Park, B*	40 51.7 N	286 07	Feb 24, 10	.....	.....	15.2	72 07.4 N	.....	.....	..	201.12	C I
			Feb 25, 10	.....	.....	11.4, 13.3	72 07.7 N	.....	.....	..	201.12	C I
			Feb 28, 10	.....	.....	.....	.....	12.3, 14.1	.18527	4	.....	C I
			Feb 28, 10	.....	.....	.....	.....	15.0, 15.8	.18529	4	.....	C I
			Mar 1, 10	.....	.....	.....	.....	11.2, 12.1	.18516	2	.....	C I
			Mar 1, 10	.....	.....	.....	.....	13.7, 14.6	.18518	2	.....	C I
			Mar 3, 10	.....	.....	.....	.....	11.2, 12.2	.18531	2	.....	C I
			Mar 3, 10	.....	.....	.....	.....	14.2, 15.1	.18522	4	.....	C I
			Mar 4, 10	11.0 to 12.3(6)	11 11.9 W	.....	.....	.....	.....	4	.....	C I
			Mar 4, 10	13.7 to 15.5(7)	11 17.7 W	.....	.....	.....	.....	2	.....	C I
			Mar 9, 10	11.1, 12.1, 16.0	11 13.0 W	.....	.....	.....	.....	4	.....	C I
			Mar 11, 10	9.8 to 12.0(6)	11 10.9 W	14.8	72 07.3 N	.....	.....	4	201.12	C I
Havre de Grace, Island	39 33.4 N	283 55	Oct 30, 08	9.4, 10.6	6 03.0 W	13.6	70 52.7 N	9.8, 10.3	.19468	7	172.12	S&S
			Oct 30, 08	14.0	6 05.0 W	.....	.....	16.1	*.19447*	*172*	.....	S&S
Havre de Grace, Lighthouse	39 32.4 N	283 55	Oct 26, 08	14.6	6 09.1 W	.....	.....	.....	.....	7	.....	S&S
			Oct 27, 08	9.1, 12.3	6 05.2 W	15.0	71 05.6 N	9.7, 11.1	.19055	7	172.12	S&S
			Oct 27, 08	13.5	6 07.6 W	.....	.....	16.4	*.19066*	*172*	.....	S&S
			Oct 28, 08	13.8	6 09.7 W	9.6	71 07.0 N	14.6, 16.3	.19119	7	172.12	S&S
			Oct 28, 08	8.3, 12.1	6 09.9 W	.....	.....	11.1	*.19042*	*172*	.....	S&S

* Local disturbance.

NORTH AMERICA.

UNITED STATES—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Chestertown	39 13.2 N	283 56	Nov 2,'08	15.4	6 37.0 W	.....	.....	16.2, 17.1	.19710	7	.....	S&S
			Nov 3, 08	8.4, 15.2, 16.5	6 31.5 W	10.8	70 46.6 N	15.7	.19671	7	172.12	S&S
			Nov 3, 08	.....	.....	.....	.....	13.7	*.19612*	*172*	.....	S&S
Bowie	39 00 N	283 13	Nov 5, 08	9.4, 12.4	6 07.6 W	14.1	70 38.4 N	10.2, 11.2	.19692	7	172.12	S&S
			Nov 5, 08	13.3	6 08.3 W	.....	.....	16.0	*.19717*	*172*	.....	S&S
			Nov 6, 08	9.0, 11.7	6 07.1 W	.....	.....	9.6, 10.9	.19672	7	.....	S&S
Washington, Am	38 55.6 N	282 57	Oct 4, 05	.....	.....	11.0, 15.8	70 27.4 N	.....	.....	..	18.(56)	DCS
			Oct 6, 05	10.3, 12.1	4 30.4 W	.....	.....	10.8, 11.5	.20001	17	.....	DCS
			Oct 6, 05	14.0, 15.4	4 33.6 W	.....	.....	14.4, 15.0	.20034	17	.....	DCS
Washington, C. & G. S.	38 53 2 N	283 00	Feb 9, 05	12.2, 14.8, 15.2	5 22.3 W	.....	.....	13.0, 14.1	.20290	17	.....	DCS
Baldwin, Absolute Observatory	38 47.0 N	264 50	Dec 29, 05	9.8, 12.6	8 28.4 E	14.6 (wt.½)	68 40.0 N	11.1, 12.1	.21793	36	169.12	G II
			Dec 29, 05	.....	.....	8.7, 16.1	68 44.8 N	.....	.....	..	171.12	G II
			Dec 30, 05	7.8, 9.6	8 31.6 E	10.4 (wt.½)	68 43.6 N	8.3, 9.2	.21808	36	169.12	G II
			Jan 11, 06	.....	.....	15.0	68 43.1 N	.....	.....	..	171.12	G II
			Nov 13, 06	13.9	8 29.3 E	.....	.....	14.3	.21781	30	.....	G II
			Nov 14, 06	.....	.....	11.7, 13.8	68 46.0 N	.....	.....	..	178.12	G II
			Nov 14, 06	.....	.....	14.7	68 44.2 N	.....	.....	..	178.56	G II
			Nov 14, 06	.....	.....	10.9	68 47.6 N	.....	.....	..	4655.34	G II
			Nov 15, 06	.....	.....	9.5, 10.1	68 43.6 N	.....	.....	..	178.1256	G II
			Nov 15, 06	.....	.....	8.9	68 45.8 N	.....	.....	..	4655.34	G II
			Nov 21, 06	.....	.....	10.3, 13.9	68 45.4 N	.....	.....	..	178.12	G II
			Nov 21, 06	.....	.....	15.7	68 47.2 N	.....	.....	..	178.56	G II
			Nov 22, 06	.....	.....	9.0	68 45.0 N	.....	.....	..	178.12	G II
			Nov 24, 06	9.4, 10.9	8 34.6 E	13.7	68 45.3 N	9.8, 10.6	.21770	20	177.56	JPA
			Nov 27, 06	13.3, 14.7	8 27.0 E	9.1	68 43.9 N	13.7, 14.4	.21766	20	177.12	JPA
			Sep 10, 07	15.4, 16.8	8 27.3 E	17.5	68 44.2 N	16.2	.21715	21	24.12	LAB
			Sep 11, 07	8.6, 10.0	8 35.9 E	12.0	68 49.8 N	9.3	.21683	21	24.12	LAB
Baldwin, Tent	38 47.0 N	264 50	Nov 13, 06	14.0	8 26.5 E	.....	.....	.....	.....	36	.....	G II
			Nov 14, 06	.....	.....	10.9, 15.5	68 43.2 N	.....	.....	..	178.12	G II
			Nov 14, 06	.....	.....	16.0	68 43.7 N	.....	.....	..	178.56	G II
			Nov 14, 06	.....	.....	11.8, 14.3	68 44.8 N	.....	.....	..	4655.34	G II
			Nov 15, 06	.....	.....	8.2, 8.9	68 42.8 N	.....	.....	..	178.1256	G II
			Nov 15, 06	.....	.....	9.7	68 45.0 N	.....	.....	..	4655.34	G II
Cheltenham Observatory, Bi	38 44.0 N	283 10	Feb 4, 08	.....	.....	11.3	70 31.2 N	.....	.....	..	177.1256	JCP
			Feb 5, 08	13.6, 15.6	5 33.3 W	9.9	70 30.5 N	14.6, 16.5	.19931	5	177.1256	JCP
			Feb 6, 08	8.2, 10.3, 11.7	5 26.4 W	15.0	70 31.5 N	9.2, 11.0	.19916	5	177.1256	JCP
			Feb 7, 08	11.3, 14.4, 14.6	5 30.7 W	9.6	70 30.8 N	12.8, 15.3	.19908	5	177.1256	JCP
			Feb 7, 08	16.0, 16.2, 16.3	5 31.2 W	.....	.....	.....	.....	5	.....	JCP
			Feb 8, 08	8.6, 10.5	5 25.0 W	.....	.....	9.6	.19939	5	.....	JCP
			Mar 24, 08	11.4, 15.4, 15.7	5 31.7 W	.....	.....	14.4, 16.4	.19936	7	.....	HWF
			Mar 25, 08	7.9, 10.3, 11.4	5 27.1 W	.....	.....	9.0, 13.7	.19938	7	.....	HWF
			Mar 25, 08	14.8, 16.5	5 33.8 W	.....	.....	15.6	.19956	7	.....	HWF
			Mar 26, 08	8.0	5 27.2 W	.....	.....	8.9, 11.2	.19938	7	.....	HWF
			Mar 26, 08	.....	.....	.....	.....	14.7	.19869	7	.....	HWF
			Mar 27, 08	.....	.....	.....	.....	8.9, 10.7	.19901	7	.....	HWF
			Mar 31, 08	.....	.....	15.8, 16.7	70 30.6 N	.....	.....	..	EI 48	HWF
			Apr 1, 08	.....	.....	8.8, 9.8	70 33.2 N	.....	.....	..	EI 48	HWF
			Apr 1, 08	.....	.....	13.8, 14.5	70 30.5 N	.....	.....	..	EI 48	HWF
			Apr 1, 08	.....	.....	15.2, 16.1	70 30.9 N	.....	.....	..	EI 48	HWF
			Apr 2, 08	.....	.....	8.8, 9.4	70 32.9 N	.....	.....	..	EI 48	HWF
			Apr 5, 10	13.1, 14.7	5 45.4 W	.....	.....	14.0	.19817	5	.....	JCP
			Apr 5, 10	15.1, 16.6	5 43.0 W	.....	.....	15.8	.19830	5	.....	JCP
			Apr 6, 10	7.5, 9.4, 9.8	5 37.4 W	.....	.....	8.5, 10.5	.19800	5	.....	JCP
			Apr 6, 10	11.3, 11.7, 14.7	5 44.2 W	.....	.....	13.8, 15.8	.19819	5	.....	JCP
			Apr 6, 10	15.0, 16.5	5 42.4 W	.....	.....	.....	.....	5	.....	JCP
			Apr 7, 10	.....	.....	8.8, 10.7	70 35.8 N	.....	.....	..	177.1256	JCP
			Apr 7, 10	.....	.....	13.7, 16.2	70 35.1 N	.....	.....	..	177.1256	JCP
			Apr 8, 10	.....	.....	8.8, 10.7	70 36.0 N	.....	.....	..	177.1256	JCP
San Rafael, C. & G. S. '97, Mag'r	37 58.6 N	237 27	Jul 27, 05	9.6, 11.4	17 38.6 E	12.6	62 13.9 N	10.1, 11.0	.25157	36	171.12	G I
			May 26, 08	13.0, 15.4	17 50.6 E	.....	.....	13.6, 14.8	.25100	4	.....	G III
			May 27, 08	11.2, 12.0	17 52.0 E	.....	.....	10.7, 11.5	.25138	4	.....	G III
San Rafael, C. & G. S. '97, Dip	37 58.6 N	237 27	Jul 27, 05	.....	.....	13.6, 14.0	62 13.0 N	.....	.....	..	171.12	G I
			May 27, 08	.....	.....	8.9, 16.0	62 14.8 N	.....	.....	..	178.12	G III

NORTH AMERICA.

UNITED STATES—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
San Rafael, North Pier	37 58.6 N	237 27	May 27,'08	13.4, 15.1	17 51.3 E	.....	.....	13.8, 14.6	.25120	4	.....	G III
			May 26, 08	.....	.....	16.5	62 16.8 N	.....	.....	..	178.12	G III
Berkeley	37 52.2 N	237 44	Jul 25, 05	11.0	17 32.3 E	11.7, 13.1	62 10.2 N	12.5, 13.8	*.25216*	*169*	169.12	G I
Goat Island	37 48.7 N	237 38	Jul 14, 05	10.2, 12.0	17 34.2 E	.....	.....	10.9, 11.8	.25256	36	.....	G I
			Jul 14, 05	13.2, 15.0	17 34.0 E	.....	.....	13.8, 14.8	.25299	36	.....	G I
			Jul 15–21	.....	.....	Various	62 06.0 N	.....	.....	..	Various	G I
			Jul 22, 05	11.3, 13.5	17 36.2 E	.....	.....	12.2, 13.2	.25276	36	.....	G I
			May 29, 08	10.1, 11.7	17 50.6 E	.....	.....	10.5, 11.2	.25225	4	.....	G III
			May 29, 08	12.8, 14.3	17 47.8 E	9.1, 15.1	62 05.6 N	13.2, 13.9	.25252	4	178.12	G III
			May 30, 08	11.6, 15.0	17 52.1 E	16.2	62 05.0 N	12.4, 14.3	25234	4	178.12	G III
			May 26–27	.....	.....	Various	62 05.3 N	.....	.....	..	Various	G III
Goat Island, First Secondary	37 48.7 N	237 38	May 30, 08	.....	.....	14.0	62 05.8 N	.....	.....	..	178.12	G III
			May 30, 08	.....	.....	12.6, 14.9	62 06.5 N	.....	.....	..	189.56	G III
Presidio	37 47.5 N	237 32	Jul 17, 05	15.0	16 55.2 E	13.6	62 43.0 N	14.3	*.24878*	*169*	169.12	G I
Norfolk	36 52.4 N	283 44	Feb 11, 05	15.4, 17.2	4 41.1 W	.....	.....	16.1, 16.8	.21338	19	.....	JPA
			Feb 14, 05	.....	.....	11.8	68 40.8 N	.....	.....	..	171.12	JPA
			Mar 14, 05	.....	.....	10.1	68 39.3 N	11.0	*.21374*	*34*	34.12	DCS
			Mar 15, 05	10.2, 10.7, 13.0	4 36.2 W	.....	.....	.....	.....	17	.....	DCS
San Diego, III	32 44.7 N	242 48	Aug 21, 05	15.8, 16.0	14 38.8 E	.....	.....	.....	.....	36	.....	G I
			Dec 14, 05	10.9, 13.3	14 40.4 E	14.8	58 03.4 N	11.8, 12.8	.27693	36	171.12	G I
			Dec 15, 05	.....	.....	9.5(wt.½)	58 07.4 N	.....	.....	..	169.12	G I
San Diego, C. & G. S. 1897	32 42 N	242 46	Aug 14, 05	11.2, 13.8	13 58.7 E	14.5(wt.½)	58 09.2 N	11.6, 12.4	.27675	36	169.12	G I
			Aug 14, 05	.....	.....	16.0	58 04.7 N	.....	.....	..	171.12	G I
San Diego, II.	32 40.9 N	242 48	Aug 19, 05	13.9, 15.4	14 27.6 E	11.5	58 02.5 N	14.3, 15.0	.27680	36	171.12	G I
San Diego, I	32 40.8 N	242 47	Aug 16, 05	14.4, 15.7	14 40.8 E	11.4	58 05.4 N	14.7, 15.3	.27730	36	171.12	G I
			Aug 17, 05	.....	.....	10.8(wt.½)	58 06.4 N	.....	.....	..	169.12	G I
			Aug 21, 05	10.2, 10.7	14 40.2 E	.....	.....	.....	.....	36	.....	G I
			Dec 16, 05	13.7	14 41.9 E	12.1	58 05.0 N	14.1, 14.7	.27734	36	171.12	G I
			Dec 18, 05	.....	.....	12.1(wt.½)	58 08.0 N	.....	.....	..	169.12	G I
			Jan 20 to Feb 3, 06	.....	.....	Various	58 05.9 N	.....	.....	..	Various	G II
			Jan 23, 06	13.2, 14.8	14 43.2 E	.....	.....	.....	.....	36	.....	G II
			Jan 24, 06	10.2, 12.3, 13.6	14 44.8 E	.....	.....	10.8, 11.8	.27714	36	.....	G II
			Jan 29, 06	10.8, 14.6	14 44.6 E	.....	.....	11.8, 13.9	.27726	36	.....	G II
			Feb 24, 06	10.1, 14.6	14 41.6 E	.....	.....	10.4, 14.1	.27678	36	.....	G II
			Oct 25, 06	.....	.....	16.4	58 05.8 N	.....	.....	..	178.1256	G II
			Oct 27, 06	10.0, 11.5	14 45.8 E	.....	.....	10.4, 11.2	.27682	36	.....	G II
			Oct 27, 06	13.4, 14.7	14 45.4 E	.....	.....	13.7, 14.3	.27702	36	.....	G II
			Dec 5 to Dec 11, 06	.....	.....	Various(8)	58 06.0 N	.....	.....	..	35.12 & 178.1256	G II
			Dec 17, 06	15.7, 16.6	14 47.2 E	.....	.....	.....	.....	1	.....	G III
San Diego, Secondary	32 40.8 N	242 47	Dec 5 to Dec 8, 06	Various(6)	14 46.6 E	Various(6)	58 06.3 N	.....	.....	*35* & *178*	35.12 & 178.1256	G III
Waycross	31 13.9 N	277 38	Jun 16, 05	15.1	1 09.0 E	.....	.....	.....	.....	19	.....	JPA
			Jun 17, 05	8.2, 9.6	1 13.8 E	11.1	62 19.8 N	8.5, 9.1	.25993	19	171.12	JPA
Miami	25 47.0 N	279 48	Jun 14, 05	9.4, 10.7	1 37.8 E	15.5, 16.1	56 33.3 N	9.8, 10.4	.28694	19	171.12	JPA
			Jun 14, 05	13.6, 14.8	1 35.2 E	.....	.....	13.9, 14.4	.28707	19	.....	JPA
			Nov 24, 08	15.2	1 34.4 E	.....	.....	.....	.....	7	.....	WHS
			Nov 25, 08	10.4, 12.9, 16.2	1 34.1 E	.....	.....	14.4, 15.6	.28366	7	.....	WHS
			Nov 26, 08	.....	.....	13.8	56 55.7 N	14.9	*.28335*	*172*	172.12	WHS
			Nov 27, 08	10.0, 13.7	1 34.4 E	.....	.....	10.5, 13.0	.28370	7	.....	WHS
Knight's Key	24 42.6 N	278 52	Nov 30, 08	9.8, 13.0	2 04.4 E	14.6	55 31.5 N	10.3, 11.2	.28843	7	172.12	WHS
			Nov 30, 08	.....	.....	.....	.....	15.6	*.28864*	*172*	.....	WHS
			Dec 1, 08	9.9, 12.7, 15.1	2 04.3 E	.....	.....	9.9, 13.2	.28867	7	.....	WHS
			Dec 1, 08	.....	.....	.....	.....	14.3	.28900	7	.....	WHS
Key West	24 33.5 N	278 12	May 12, 05	9.6, 11.3, 11.6	2 33.6 E	14.0	54 57.1 N	10.1, 10.9	.29410	19	171.12	JPA
			May 13, 05	8.6, 10.4	2 31.6 E	10.9	54 56.0 N	9.0, 10.0	.29381	19	171.12	JPA

SOUTH AMERICA.

BRAZIL.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Pinheiro, A.	1 17.9 S	311 31	Sep 29,'10	9.4, 11.1	7 54.4 W	.....	.....	10.0, 10.8	.29064	4	.....	C II
			Sep 30, 10	9.4, 10.9	7 50.8 W	.....	.....	9.9, 10.5	.29071	4	.....	C II
			Sep 30, 10	12.9, 14.6	7 52.0 W	.....	.....	13.3, 14.0	.29080	4	.....	C II
			Oct 1, 10	9.3, 10.8	7 53.0 W	.....	.....	9.8, 10.4	.29087	2	.....	C II
			Oct 1, 10	12.7, 14.2	7 51.5 W	.....	.....	13.1, 13.7	.29060	2	.....	C II
			Oct 1, 10	14.3, 15.6	7 52.4 W	.....	.....	14.7, 15.3	.29049	2	.....	C II
			Oct 3, 10	9.2, 10.7	7 52.0 W	.....	.....	9.6, 10.3	.29133	2	.....	C II
			Oct 3, 10	12.9, 14.2	7 52.2 W	.....	.....	13.3, 13.9	.29082	2	.....	C II
			Oct 3, 10	14.6, 15.8	7 53.4 W	.....	.....	14.9, 15.5	.29060	2	.....	C II
			Oct 6, 10	.....	.....	10.1, 10.7	23 03.1 N	.....	.....	..	201.12	C II
			Oct 6, 10	.....	.....	11.2, 11.8	23 02.2 N	.....	.....	..	201.12	C II
			Oct 6, 10	.....	.....	13.7, 14.3	23 08.8 N	.....	.....	..	201.12	C II
			Oct 6, 10	.....	.....	14.9, 15.6	23 13.4 N	.....	.....	..	201.12	C II
Pinheiro, B.	1 17.9 S	311 31	Oct 1, 10	9.3, 10.7	7 53.0 W	.....	.....	9.8, 10.4	.29101	4	.....	C II
			Oct 1, 10	12.7, 14.1	7 52.6 W	.....	.....	13.1, 13.7	.29078	4	.....	C II
			Oct 1, 10	14.3, 15.6	7 52.7 W	.....	.....	14.6, 15.2	.29064	4	.....	C II
			Oct 7, 10	.....	.....	9.4, 10.0	23 03.4 N	.....	.....	..	201.12	C II
			Oct 7, 10	.....	.....	10.5, 11.0	23 04.4 N	.....	.....	..	201.12	C II
			Oct 7, 10	.....	.....	13.3, 14.2	23 05.2 N	.....	.....	..	201.12	C II
			Oct 7, 10	.....	.....	14.8, 15.4	23 07.4 N	.....	.....	..	201.12	C II
Pinheiro, C.	1 17.9 S	311 31	Sep 29, 10	9.4, 11.2	7 55.3 W	.....	.....	9.9, 10.7	.29064	2	.....	C II
			Sep 30, 10	9.4, 11.0	7 51.5 W	.....	.....	9.9, 10.5	.29072	2	.....	C II
			Sep 30, 10	12.9, 14.6	7 52.7 W	.....	.....	13.3, 14.0	.29100	2	.....	C II
			Oct 3, 10	9.2, 10.7	7 52.6 W	.....	.....	9.6, 10.3	.29128	4	.....	C II
			Oct 3, 10	12.9, 14.2	7 52.8 W	.....	.....	13.3, 13.9	.29088	4	.....	C II
			Oct 3, 10	14.5, 15.8	7 53.7 W	.....	.....	14.9, 15.5	.29074	4	.....	C II
Amazon 9.	2 28.9 S	294 38	Sep 2, 10	10.2, 11.0	2 33.0 E	11.6	19 27.2 N	10.4, 10.8	.30208	13	177.12	CCS
Amazon 10.	2 29.0 S	294 02	Sep 3, 10	11.5, 12.9	3 01.0 E	10.8	19 08.0 N	12.0, 12.7	.30160	13	177.1256	CCS
Amazon 12.	2 37.2 S	292 49	Sep 6, 10	10.5, 11.4	3 11.8 E	9.9	18 33.1 N	10.8, 11.2	.30230	13	177.1256	CCS
Amazon 11.	2 37.9 S	293 24	Sep 5, 10	9.4, 10.4	3 13.0 E	11.3	18 31.1 N	9.7, 10.2	.30239	13	177.125	CCS
Amazon 8.	3 00.1 S	294 58	Sep 1, 10	11.1	2 47.7 E	10.5	18 36.3 N	11.4	.30114	13	177.1256	CCS
Manáos, II.	3 07.5 S	300 01	Aug 2, 10	.....	.....	9.6	20 06.9 N	.....	.....	..	177.1256	CCS
			Aug 3, 10	12.6	0 07.2 E	.....	.....	13.0, 13.6	.29476	13	.....	CCS
			Aug 3, 10	.....	.....	.....	.....	14.1, 14.6	.29451	13	.....	CCS
			Aug 3, 10	.....	.....	.....	.....	15.0, 15.6	.29442	13	.....	CCS
			Aug 3, 10	.....	.....	.....	.....	16.0, 16.5	.29431	13	.....	CCS
Manáos, I.	3 08.5 S	300 00	Jul 20, 10	15.2, 16.3	0 06.8 E	14.0	20 01.8 N	15.5, 16.0	.29461	13	177.1256	CCS
Amazon 13.	3 11.1 S	292 06	Sep 8, 10	10.5, 11.4	4 00.8 E	9.7	17 35.2 N	10.8, 11.2	.30327	13	177.125	CCS
Amazon 1.	3 16.3 S	299 56	Aug 21, 10	12.7, 13.8	0 23.7 E	15.0	19 53.5 N	13.0, 13.5	.29317	13	177.12	CCS
Amazon 2.	3 23 S	299 19	Aug 22, 10	15.0, 16.0	0 41.7 E	13.7	19 31.1 N	15.3, 15.7	.28922	13	177.125	CCS
Amazon 14.	3 30 S	291 02	Sep 10, 10	8.3, 9.2	4 22.8 E	7.3	16 39.8 N	8.5, 8.9	.30430	13	177.12	CCS
Amazon 3.	3 34.9 S	298 50	Aug 23, 10	12.4, 13.0	0 31.0 E	13.7	19 21.6 N	12.7	.29397	13	177.56	CCS
Amazon 7.	3 35 S	295 49	Aug 29, 10	12.6, 13.6	2 21.6 E	14.5	17 55.3 N	13.0, 13.4	.29706	13	177.125	CCS
Amazon 15.	3 50.0 S	290 36	Sep 11, 10	10.3, 11.2	4 36.2 E	9.5	15 36.6 N	10.6, 10.9	.30408	13	177.1256	CCS
Amazon 4.	3 51.1 S	298 14	Aug 24, 10	12.4	1 40.6 E	10.9	19 02.7 N	11.6	.29286	13	177.125	CCS
Amazon 6.	3 51.3 S	296 22	Aug 28, 10	13.7, 14.3	2 09.8 E	12.8	17 36.0 N	13.9	.29590	13	177.256	CCS
Amazon 5.	4 03.0 S	297 01	Aug 27, 10	10.2, 11.1	1 57.6 E	11.6	17 28.0 N	10.5, 10.8	.29555	13	177.12	CCS
Amazon 16.	4 15.7 S	290 31	Sep 12, 10	10.1, 10.9	4 48.0 E	9.3	14 59.2 N	10.3, 10.7	.30314	13	177.1256	CCS
Rio de Janeiro, A.	22 58.7 S	316 49	Dec 9, 10	10.5, 12.3	9 49.1 W	.....	.....	11.1, 12.0	.24702	4	.....	C II
			Dec 9, 10	14.5, 16.0	9 48.8 W	.....	.....	14.9, 15.6	.24708	4	.....	C II
			Dec 9, 10	16.2, 17.6	9 50.3 W	.....	.....	16.6, 17.2	.24702	4	.....	C II
			Dec 10, 10	8.8, 10.3	9 51.6 W	.....	.....	9.2, 9.8	.24700	2	.....	C II
			Dec 10, 10	12.5, 14.4	9 48.8 W	.....	.....	12.9, 14.1	.24736	2	.....	C II
			Dec 10, 10	14.7, 16.1	9 51.6 W	.....	.....	15.1, 15.7	.24679	2	.....	C II
			Dec 12, 10	9.1, 10.8, 12.5	9 48.0 W	.....	.....	9.6, 10.3	.24724	2	.....	C II
			Dec 12, 10	13.9, 14.2, 15.7	9 50.0 W	.....	.....	12.8, 13.5	.24740	2	.....	C II
			Dec 12, 10	17.3, 17.6, 18.0	9 49.8 W	.....	.....	14.5, 15.2	.24712	2	.....	C II
			Dec 12, 10	18.3	9 49.6 W	.....	.....	.....	.....	2	.....	C II
			Dec 13, 10	.....	.....	14.4, 15.2	14 47.8 S	.....	.....	..	EI 2	C II
			Dec 13, 10	.....	.....	15.8, 16.3	14 49.2 S	.....	.....	..	EI 2	C II
			Dec 14, 10	.....	.....	10.6, 12.8	14 48.8 S	.....	.....	..	201.12	C II
			Dec 14, 10	.....	.....	13.6, 14.3	14 49.3 S	.....	.....	..	201.12	C II
Rio de Janeiro, B.	22 58.7 S	316 49	Dec 12, 10	9.1, 10.8	9 49.1 W	.....	.....	9.6, 10.4	.24740	4	.....	C II
			Dec 12, 10	12.4, 13.8	9 47.9 W	.....	.....	12.9, 13.5	.24722	4	.....	C II
			Dec 12, 10	14.2, 15.7	9 51.2 W	.....	.....	14.6, 15.2	.24714	4	.....	C II
			Dec 13, 10	.....	.....	14.2, 15.1	14 49.0 S	.....	.....	..	201.12	C II
			Dec 13, 10	.....	.....	15.7, 16.4	14 51.0 S	.....	.....	..	201.12	C II

SOUTH AMERICA.

BRAZIL—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Rio de Janeiro, B.	22 58.7 S	316 49	Dec 14,'10	.....	.....	10.6, 13.0	14 49.7 S	.....	.....	..	E1 2	C 11
			Dec 14, 10	.....	.....	13.9, 14.8	14 50.2 S	.....	.....	..	E1 2	C 11
			Dec 14, 10	.....	.....	15.7, 16.5	14 50.4 S	.....	.....	..	E1 2	C 11
			Dec 15, 10	.....	.....	9.5, 10.2	14 48.6 S	.....	.....	..	E1 2	C 11
			Dec 15, 10	.....	.....	11.0, 11.5	14 50.4 S	.....	.....	..	E1 2	C 11
			Dec 15, 10	.....	.....	13.8, 14.5	14 51.7 S	.....	.....	..	E1 2	C 11
			Dec 15, 10	.....	.....	15.3, 16.1	14 51.7 S	.....	.....	..	E1 2	C 11
Rio de Janeiro, C.	22 58.7 S	316 49	Dec 9, 10	10.6, 12.4	9 49.4 W	.....	.....	11.1, 11.9	.24712	2	.....	C 11
			Dec 9, 10	14.5, 16.0	9 48.4 W	.....	.....	14.9, 15.6	.24712	2	.....	C 11
			Dec 9, 10	16.2, 17.6	9 50.2 W	.....	.....	16.6, 17.2	.24675	2	.....	C 11
			Dec 10, 10	8.7, 10.3	9 51.6 W	.....	.....	9.2, 9.9	.24699	4	.....	C 11
			Dec 10, 10	12.5, 14.4	9 48.6 W	.....	.....	13.0, 14.1	.24719	4	.....	C 11
			Dec 10, 10	14.6, 16.1	9 51.2 W	.....	.....	15.1, 15.7	.24684	4	.....	C 11

COLOMBIA.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Riohacha	11 33.8 N	287 04	Mar 3,'09	9.7, 11.5	2 14.5 E	7.8	39 07.4 N	10.2, 11.0	.31665	9	178.56	EK
Santa Marta	11 16.3 N	285 48	Feb 21, 09	9.9	2 35.7 E	15.0	38 34.4 N	10.4, 11.8	.31846	9	178.56	EK
			Mar 7, 09	14.6	2 35.6 E	.....	.....	11.0, 13.8	.31817	9	.....	EK
Savanilla	10 58.3 N	285 00	Jul 23, 08	.....	.....	15.3	37 56.1 N	15.7	*.31954*	*189*	189.356	HWF
			Feb 17, 09	10.8	2 53.7 E	14.8	38 00.2 N	11.4	.31890	9	178.56	EK
Cartagena	10 25.8 N	284 27	Jul 22, 08	14.4	3 20.2 E	14.9	36 55.4 N	.....	.....	*189*	189.56	HWF
			Mar 16, 09	10.0, 11.7	3 14.4 E	13.9	37 05.4 N	10.5, 11.3	.31996	9	178.56	EK
Calamar	10 15.7 N	285 07	Feb 13, 09	13.2, 15.2	3 04.7 E	.....	.....	13.8, 14.6	.31971	9	.....	EK
			Feb 14, 09	.....	.....	10.5	36 57.8 N	.....	.....	..	178.56	EK
Mompos	9 14.2 N	285 30	Feb 10, 09	10.5	3 08.2 E	14.7	35 24.0 N	11.0, 11.8	.31952	9	178.56	EK
			Feb 11, 09	10.5	3 08.5 E	.....	.....	11.0	.31958	9	.....	EK
Lorica	9 13.9 N	284 12	Mar 26, 09	10.6, 14.8	3 29.4 E	.....	.....	11.2, 14.2	.32158	9	.....	EK
			Mar 27, 09	.....	.....	10.0	35 05.0 N	13.7	.32166	9	178.56	EK
Banco	8 59.4 N	285 55	Feb 8, 09	10.2	3 07.1 E	14.5	35 09.4 N	10.7, 11.4	.31914	9	178.56	EK
Bodega Central	8 08.7 N	286 03	Feb 5, 09	11.1, 17.0	3 09.2 E	14.4	34 06.8 N	11.6, 16.5	.31921	9	178.56	EK
Puerto Wilches	7 16.6 N	286 01	Feb 1, 09	14.2	3 22.1 E	11.5	32 36.4 N	14.7	.31957	9	178.56	EK
Puerto Berrio	6 29.4 N	285 30	Jan 30, 09	16.3	3 50.8 E	14.1	31 14.8 N	16.9	.31949	9	178.56	EK
Honda	5 12.5 N	285 10	Jan 28, 09	13.6, 17.0	4 19.8 E	11.2	29 30.8 N	14.2, 16.4	.31710	9	178.56	EK
Bogota	4 37.9 N	285 48	Jan 15, 09	9.9	4 06.9 E	14.7	27 49.4 N	10.5, 11.3	.31928	9	178.12	EK
			Jan 22, 09	.....	.....	15.2	27 50.2 N	.....	.....	..	178.12	EK
Girardot	4 18.2 N	285 05	Jan 10, 09	10.2	4 22.9 E	15.0	27 02.7 N	10.7, 11.5	.31980	9	178.56	EK
Buenaventura	3 53 N	282 58	Apr 28, 09	15.2	4 52.0 E	17.3	25 48.1 N	15.8	.32265	9	178.6	EK
			May 17, 09	14.1	4 49.9 E	.....	.....	14.8	.32208	9	.....	EK
Natagaima	3 37.8 N	284 45	Jan 7, 09	13.9, 17.5	4 32.0 E	.....	.....	14.5, 16.8	.31904	9	.....	EK
			Jan 8, 09	.....	.....	10.6	26 01.7 N	.....	.....	..	178.56	EK
Neiva	2 55.5 N	284 37	Dec 31, 09	.....	.....	13.9, 15.2	24 53.0 N	.....	.....	..	178.1256	EK
			Jan 3, 09	9.8, 11.6	4 56.6 E	.....	.....	10.3, 11.1	.31816	9	.....	EK
			Jan 3, 09	14.5, 14.7	4 50.6 E	.....	.....	.....	.....	9	.....	EK
			Jan 4, 09	9.9, 15.1	4 55.2 E	.....	.....	9.5 to 15.9 (5 sets)	.31851	9	.....	EK
Popayan	2 26.8 N	283 24	Dec 9, 08	9.8, 13.0	5 07.9 E	14.4	23 51.8 N	10.7, 11.7	.32025	9	178.56	EK
			Dec 10, 08	10.4, 10.6, 10.9	5 05.4 E	.....	.....	.....	.....	9	.....	EK
			Dec 10, 08	11.2, 11.5, 13.1	5 05.6 E	.....	.....	.....	.....	9	.....	EK
			Dec 10, 08	15.3, 14.5, 16.6	5 06.4 E	.....	.....	.....	.....	9	.....	EK
			Dec 11, 08	.....	.....	.....	.....	9.9, 11.2	.32044	9	.....	EK
			Dec 11, 08	.....	.....	.....	.....	12.4, 14.7	.32032	9	.....	EK
			Dec 11, 08	.....	.....	.....	.....	15.5, 15.9	.32000	9	.....	EK
			Dec 12, 08	.....	.....	11.2, 15.7	23 55.5 N	.....	.....	..	178.1256	EK
			Dec 12, 08	.....	.....	16.8	23 54.4 N	.....	.....	..	178.12	EK
La Plata	2 24.2 N	284 08	Dec 22, 08	10.4, 15.0	5 05.6 E	.....	.....	.....	.....	9	.....	EK
			Dec 23, 08	8.7, 11.4	5 05.5 E	14.2	23 38.4 N	9.4, 10.6	.31983	9	178.1256	EK
Casa Fria	1 49.9 N	282 55	Dec 3, 08	13.6	5 29.4 E	16.6	22 25.1 N	14.4	.32072	9	178.56	EK
Tumaco	1 48.3 N	281 14	May 2, 09	10.1	5 56.0 E	14.1	22 19.3 N	10.7, 11.5	.32123	9	178.56	EK
			May 3, 09	8.8, 13.0, 15.0	5 57.0 E	.....	.....	9.3, 10.1	.32101	9	.....	EK
			May 3, 09	.....	.....	.....	.....	11.2, 12.3	.32118	9	.....	EK
			May 3, 09	.....	.....	.....	.....	13.6, 14.5	.32094	9	.....	EK
			May 13, 09	9.8, 11.6	5 56.5 E	13.7	22 20.9 N	10.4, 11.2	.32135	9	178.56	EK
Barbacoas	1 46 N	281 51	May 7, 09	.....	.....	12.8	21 58.2 N	10.3	.32188	9	178.56	EK
Pasto	1 13.1 N	282 43	Nov 25, 08	9.7, 12.9	5 36.4 E	16.6	21 01.5 N	10.4, 11.9	.32087	9	178.56	EK
			Nov 26, 08	.....	.....	.....	.....	10.0, 11.0	.32085	9	.....	EK

SOUTH AMERICA.

ECUADOR.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Esmeraldas	0 58.0 N	280 15	Sep 7,'08	11.1, 13.1	6 07.0 E	.....	.....	14.6, 16.1	.32346	9	.....	EK
			Sep 8, 08	.....	.....	13.7	19 56.3 N	.....	.....	..	178.12	EK
			Sep 9, 08	9.7, 10.2, 13.0	6 05.4 E	.....	.....	.....	.....	9	.....	EK
			Sep 9, 08	13.5, 14.0, 14.6	6 05.6 E	.....	.....	.....	.....	9	.....	EK
			Sep 9, 08	15.0, 16.3	6 06.4 E	.....	.....	.....	.....	9	.....	EK
			Sep 10, 08	.....	.....	9.5, 12.4	19 53.5 N	.....	.....	..	178.56	EK
			Sep 10, 08	.....	.....	15.8	19 55.0 N	.....	.....	..	178.12	EK
			Sep 11, 08	13.0	6 05.9 E	.....	.....	9.8, 12.2	.32415	9	.....	EK
			Sep 11, 08	.....	.....	.....	.....	13.1, 14.6	.32392	9	.....	EK
			Sep 11, 08	.....	.....	.....	.....	15.1, 16.0	.32343	9	.....	EK
			Sep 12, 08	.....	.....	9.2	19 52.8 N	.....	.....	..	178.56	EK
			Sep 28, 08	12.2, 14.2	6 06.0 E	13.2	19 53.2 N	.....	.....	*178*	178.56	EK
Tulcan	0 48.3 N	282 24	Nov 17, 08	15.1	5 30.1 E	15.2	20 09.0 N	.....	.....	*178*	178.56	EK
			Nov 18, 08	8.8	5 30.4 E	.....	.....	9.7, 11.0	.32246	9	.....	EK
Hacienda Caucha	0 30 N	280 35	Sep 20, 08	11.8, 14.6	6 03.0 E	.....	.....	12.5, 13.9	.32386	9	.....	EK
			Sep 21, 08	.....	.....	10.8, 13.4	19 17.6 N	.....	.....	..	178.156	EK
Ibarra	0 23 N	281 50	Nov 12, 08	12.9	5 49.8 E	.....	.....	14.3, 16.0	.32088	9	.....	EK
			Nov 13, 08	15.3	5 51.2 E	13.1	19 19.0 N	.....	.....	9	178.56	EK
Quito	0 13.0 S	281 20	Oct 22, 08	10.2, 12.6	6 19.2 E	11.0, 15.1	18 43.6 N	10.8, 11.9	.32211	9	178.56	EK
Quito, Secondary	0 13.0 S	281 20	Oct 25, 08	.....	.....	10.0	18 49.2 N	.....	.....	..	178.12	EK
Bahia	0 35 S	279 33	Sep 30, 08	.....	.....	15.4	16 32.1 N	16.2	*.32219*	*178*	178.5	EK
Manta	0 57 S	279 16	Sep 3, 08	8.2	7 01.9 E	9.1	15 27.9 N	.....	.....	*178*	178.2	EK
			Oct 1, 08	9.0	7 04.9 E	11.2	15 26.8 N	10.5	*.32086*	*178*	178.5	EK
Riobamba	1 39.4 S	281 18	Oct 15, 08	15.5	6 29.7 E	.....	.....	16.2	.31848	9	.....	EK
			Oct 16, 08	10.0	6 31.3 E	8.0	15 41.2 N	10.7	.31919	9	178.56	EK
Guayaquil	2 11.9 S	280 09	Jul 28, 08	8.2	6 48.3 E	.....	.....	10.1	.31768	9	.....	EK
			Jul 29, 08	15.0	6 44.2 E	15.1	14 36.5 N	.....	.....	*178*	178.12	EK
Salinas	2 12 S	278 59	Oct 5, 08	8.0, 10.8	6 59.8 E	15.5	13 49.0 N	8.7, 10.2	.31990	9	178.56	EK
Santa Rosa	3 28.3 S	280 03	Aug 21, 08	14.1	7 10.3 E	.....	.....	15.0, 16.5	.31817	9	.....	EK
			Aug 22, 08	.....	.....	13.6	11 25.8 N	.....	.....	..	178.1256	EK
Porto Velo	3 42.9 S	280 22	Aug 4, 08	16.6	7 09.5 E	.....	.....	.....	.....	9	.....	EK
			Aug 5, 08	9.4, 12.5	7 11.5 E	15.2	11 32.9 N	10.3, 11.7	.31758	9	178.12	EK
Loja	4 00.5 S	280 46	Aug 10, 08	9.1, 15.2	7 17.6 E	.....	.....	12.0, 14.4	.31568	9	.....	EK
			Aug 11, 08	.....	.....	.....	.....	11.2, 12.8	.31562	9	.....	EK
			Aug 12, 08	.....	.....	13.3	10 53.4 N	.....	.....	..	178.12	EK

GUIANA.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Morawhanna	8 16.0 N	300 14	Aug 20,'08	12.7, 14.0	2 12.6 W	15.1	37 45.9 N	13.0, 13.6	.29436	4	189.56	HWF
Mount Everard	7 51 N	300 32	Aug 19, 08	13.6, 15.0	2 23.2 W	9.5	37 07.8 N	14.0, 14.6	.30079	4	189.356	HWF
Arakaka	7 35.4 N	299 58	Aug 14, 08	9.6, 11.0	1 27.4 W	13.4, 16.8	36 18.9 N	10.0, 10.6	.30407	4	189.356	HWF
			Aug 15, 08	.....	.....	13.8	36 18.6 N	.....	.....	..	189.9, 10	HWF
Barima Mine	7 33 N	299 57	Aug 17, 08	14.0	1 36.5 W	12.1	36 18.2 N	13.6, 14.3	.30445	4	189.56	HWF
Suddie	7 06 N	301 32	Aug 25, 08	16.4	2 30.3 W	.....	.....	16.8	.30001	4	.....	HWF
			Aug 26, 08	10.7	2 29.6 W	8.7	35 59.0 N	9.7, 10.3	.30054	4	189.69	HWF
Georgetown	6 48.8 N	301 50	Aug 8, 08	15.5, 17.0	2 24.4 W	10.4	35 10.2 N	16.0, 16.6	.29966	4	189.356	HWF
			Aug 10, 08	.....	.....	9.9	35 12.4 N	.....	.....	..	189.56	HWF
			Aug 28, 08	12.5, 14.1	2 26.2 W	15.6	35 15.0 N	12.9, 13.6	.30028	4	189.369	HWF
			Nov 29, 08	.....	.....	13.6	35 16.5 N	9.2, 9.8	.29992	4	189.369	HWF
			Nov 30, 08	7.6 to 17.0 (d.v.)	2 28.6 W	.....	.....	.....	.....	4	.....	HWF
Bartica	6 25.0 N	301 23	Aug 30, 08	9.2, 10.5	2 05.3 W	13.7	35 01.9 N	9.6, 10.2	.29886	4	189.369	HWF
New Amsterdam	6 16.3 N	302 29	Sep 25, 08	10.1, 11.5	2 43.6 W	14.8	34 59.2 N	10.5, 11.2	.29808	4	189.369	HWF
Wismar	6 00.2 N	301 43	Sep 15, 08	13.4, 16.4	2 27.6 W	10.7	34 24.9 N	13.7, 16.0	.30006	4	189.69	HWF
Rockstone	5 59 N	301 28	Sep 14, 08	15.4	2 10.4 W	17.5	34 29.7 N	15.7, 16.3	.29818	4	189.69	HWF
Nieuw Klarenbeek	5 53 N	305 13	Nov 16, 08	15.7, 16.9	4 22.3 W	14.9	31 06.1 N	16.1, 16.6	.29591	4	189.69	HWF
Springlands	5 52.3 N	302 53	Oct 4, 08	8.9, 11.3	2 54.4 W	13.3	34 20.2 N	9.2, 10.8	.29806	4	189.69	HWF
Paramaribo	5 50.0 N	304 50	Oct 9, 08	14.1, 15.6	3 50.4 W	8.0, 17.1	34 40.1 N	14.6, 15.2	.29584	4	189.369	HWF
			Oct 10, 08	10.0, 11.2	3 48.0 W	8.0	34 38.8 N	10.3, 10.9	.29612	4	189.369	HWF
			Oct 17, 08	.....	.....	11.1, 14.3	34 35.5 N	.....	.....	..	189.69	HWF
Groningen	5 46.7 N	304 31	Nov 13, 08	14.2, 15.5	3 55.6 W	16.8	35 00.1 N	14.6, 15.2	.29204	4	189.69	HWF
Malali	5 38.8 N	301 37	Sep 17, 08	9.3, 11.3	1 53.4 W	13.5	32 48.0 N	9.8, 10.8	.30388	4	189.69	HWF
Onverwacht	5 35.2 N	304 45	Oct 20, 08	13.0, 14.3	3 58.0 W	10.6	34 31.8 N	13.4, 14.0	.29541	4	189.69	HWF
Frankville	5 35 N	302 48	Nov 23, 08	8.1	2 59.3 W	8.5	34 36.2 N	8.5	*.2978*	*189*	189.3	HWF
Albina	5 30 N	305 55	Oct 22, 08	.....	.....	16.4	33 42.6 N	.....	.....	..	189.69	HWF
			Oct 23, 08	6.8, 8.1	4 48.4 W	.....	.....	7.2, 7.7	.29701	4	.....	HWF
Potaro Mission	5 24 N	300 51	Sep 7, 08	17.2	1 36.9 W	17.6	33 27.1 N	17.6	*.3000*	*189*	189.3	HWF

SOUTH AMERICA.

GUIANA—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Tumatumari	5 24.0 N	301 00	Sep 5, 08	17.2	1 29.2 W	13.5	33 03.4 N	17.6	.30075	4	189.69	HWF
			Sep 6, 08	9.9	1 27.8 W	.....	.....	10.2, 10.7	.30175	4	.....	HWF
Saint Jean	5 23.6 N	305 56	Nov 2, 08	9.4, 11.0	4 46.0 W	15.8	33 40.4 N	9.9, 10.6	.29721	4	189.369	HWF
Kangaruma	5 22 N	300 46	Sep 8, 08	15.4	1 42.4 W	18.0	33 25.0 N	15.7, 16.3	.30009	4	189.3	HWF
Oreala	5 19.0 N	302 38	Nov 24, 08	7.0, 8.3	2 38.0 W	6.2	33 23.7 N	7.4, 8.0	.30132	4	189.3	HWF
sle Royal	5 16.7 N	307 26	Oct 29, 08	16.6, 17.6	5 05.6 W	10.7	33 21.7 N	16.9, 17.4	.29648	4	189.369	HWF
Isle Royal, B	5 16.7 N	307 26	Oct 30, 08	9.2	4 58.0 W	.....	.....	.....	.....	*189*	.....	HWF
Tukeit	5 13 N	300 33	Sep 11, 08	.....	.....	.....	.....	17.1, 17.7	.30264	4	.....	HWF
Kaieteur Falls	5 11 N	300 31	Sep 10, 08	.....	.....	.....	.....	17.2	*.30189*	*189*	.....	HWF
			Sep 11, 08	9.3, 10.0	1 18.5 W	7.6	32 55.8 N	9.6	.30237	4	189.69	HWF
Sault Hermina*	5 08.1 N	305 38	Nov 3, 08	10.1, 11.4	5 19.4 W	12.9	33 46.0 N	10.5, 11.1	.29112	4	189.69	HWF
Brownsweg	5 00 N	304 50	Nov 10, 08	.....	.....	16.8	32 58.8 N	.....	.....	..	189.69	HWF
			Nov 11, 08	6.6, 7.9	3 40.2 W	.....	.....	6.9, 7.5	.29835	4	.....	HWF
Cayenne	4 56 N	307 39	Oct 26, 08	12.8, 14.0	6 02.6 W	15.2	33 49.2 N	13.2, 13.7	.29482	4	189.69	HWF
			Oct 28, 08	9.4	6 00.8 W	.....	.....	.....	.....	4	.....	HWF
Regina	4 18.8 N	307 56	Oct 27, 08	12.3	6 02.1 W	11.2	32 36.4 N	12.6, 13.4	.29302	4	189.3	HWF

PERU.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Iquitos	3 44.9 S	286 45	Nov 4,'10	7.0, 8.0	6 04.4 E	.....	.....	7.3, 7.7	.31078	13	.....	CCS
			Nov 7, 10	.....	.....	7.0	14 11.0 N	.....	.....	..	177.125	CCS
Amazon 18	3 50.7 S	289 44	Sep 18, 10	10.1, 11.1	5 05.6 E	9.2	15 18.4 N	10.4, 10.9	.30514	13	177.1256	CCS
Amazon 19	3 57.7 S	288 47	Sep 20, 10	16.0, 16.8	5 10.5 E	15.0	14 42.6 N	16.2, 16.6	.30563	13	177.1256	CCS
San Jorge	4 02 S	286 53	Oct 2, 10	17.3	6 16.1 E	17.7	13 47.3 N	17.4	.30744	13	177.1	CCS
Amazon 17	4 11.9 S	290 01	Sep 17, 10	9.6, 10.6	4 47.4 E	8.9	14 56.1 N	9.9, 10.4	.30439	13	177.1256	CCS
Nauta	4 28 S	286 30	Oct 3, 10	9.4	6 03.6 E	10.3	12 35.8 N	9.6, 11.3	.30870	13	177.1256	CCS
Avispa	4 55 S	286 12	Oct 4, 10	6.6	6 35.9 E	6.3	11 35.3 N	6.9	.30826	13	177.56	CCS
Filadelfia	5 19 S	285 49	Oct 5, 10	13.6	6 07.9 E	13.3	10 09.6 N	11.9	.30685	13	177.12	CCS
Condor Conqui	5 28 S	285 47	Oct 6, 10	.....	.....	11.5	9 30.5 N	11.9	.30355	13	177.56	CCS
Yurimaguas I*	5 52.9 S	283 50	Nov 20, 10	7.5, 8.5	7 19.8 E	.....	.....	7.8, 8.2	.31040	13	.....	CCS
			Nov 21, 10	.....	.....	7.9	9 04.1 N	.....	.....	..	177.125	CCS
Yurimaguas II*	5 52.9 S	283 50	Feb 21, 11	8.4, 9.2	5 43.7 E	10.0	8 53.2 N	8.6, 9.0	.30915	13	177.125	CCS
Delicia	6 17 S	284 56	Oct 7, 10	8.5	6 41.5 E	9.3	8 58.3 N	8.7	.30652	13	177.12	CCS
Petronela	6 56 S	284 56	Oct 8, 10	8.4	7 00.2 E	.....	.....	8.6	.30434	13	.....	CCS
Petronela, dip station	6 56 S	284 56	Oct 8, 10	.....	.....	9.6	7 16.7 N	.....	.....	..	177.56	CCS
Cantumayo	7 21 S	285 01	Oct 9, 10	7.3, 8.2	7 11.5 E	9.1	6 40.7 N	7.6, 7.9	.30585	13	177.1256	CCS
Masisea	8 35 S	285 45	Oct 13, 10	15.2	7 02.6 E	.....	.....	12.2	.29995	13	.....	CCS
Masisea, dip station	8 35 S	285 45	Oct 23, 10	.....	.....	8.4	4 41.2 N	.....	.....	..	177.12	CCS
Sheshea	9 35 S	285 48	Oct 15, 10	.....	.....	18.3	3 26.5 N	17.7	.29881	13	177.1	CCS
Sempaya	9 42 S	285 50	Oct 19, 10	7.2, 8.1	7 52.9 E	9.2	3 12.6 N	7.4, 7.8	.29866	13	177.1256	CCS
San Lorenzo Island	12 05.3 S	282 46	Mar 14, 08	12.0, 14.0	9 17.6 E	16.6	3 27.8 S	12.6, 13.5	.29894	4	178.12	G III
			Mar 16, 08	.....	.....	11.3	3 26.9 S	.....	.....	..	178.12	G III
			Mar 17, 08	10.3, 11.4	9 16.8 E	.....	.....	10.9	.29915	4	.....	G III
San Lorenzo Island 2	12 05.3 S	282 46	Mar 13, 08	.....	.....	12.5, 13.4	3 16.0 S	.....	.....	..	178.12	G III
			Mar 13, 08	.....	.....	15.6 (wt.¼)	3 10.9 S	.....	.....	..	169.12	G III
			Mar 14, 08	15.4, 16.4	9 19.6 E	.....	.....	15.9	.29866	4	.....	G III

VENEZUELA.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Carácas	10 30.4 N	293 04	Sep 1,'05	15.4, 16.9	1 02.0 E	17.5	38 27.8 N	15.8, 16.5	.31045	17	18.56	DCS

* Local disturbance.

ISLANDS, ATLANTIC OCEAN.

BERMUDAS. –

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
St. George*	32 23.0 N	295 20	Jul 25,'07	.....	.....	16.8	64 25.8 N	.....	.....	..	172.12	HWF
			Jul 26, 07	11.1, 12.6	10 46.8 W	.....	.....	11.6, 12.3	.23537	3	.....	HWF
			Jul 26, 07	.....	.....	.....	.....	17.5	*.23577*	*172*	.....	HWF
Nonsuch Island*	32 21.1 N	295 21	Jul 29, 07	13.9, 15.9	9 46.9 W	18.0	64 48.8 N	14.5, 15.5	.23027	3	172.12	HWF
			Jul 29, 07	.....	.....	.....	.....	17.4	*.23030*	*172*	.....	HWF
Nonsuch Island, Preston's station*	32 21.1 N	295 21	Jul 29, 07	10.6, 11.7	9 37.5 W	11.2	64 47.7 N	11.2	*.23052*	*172*	172.3	HWF
Ireland Island*	32 19.4 N	295 10	Jul 15, 07	14.6, 17.1	9 28.0 W	.....	.....	15.9, 16.8	.22588	3	.....	HWF
			Jul 15, 07	.....	.....	11.3	65 40.6 N	12.5(wt.½)	*.22508*	*172*	172.12	HWF
Agar's Island, A*	32 17.6 N	295 12	Jul 6, 07	16.1	10 22.3 W	.....	.....	.....	.....	3	.....	HWF
			Jul 7, 07	13.3	10 20.0 W	16.2	67 12.9 N	11.6, 12.8	.21240	3	172.12	HWF
			Jul 8, 07	7.0 to 19.0 (d.v.)	} 10 21.7 W	.....	.....	.....	.....	3	.....	HWF
			Jul 21, 07	7.0 to 19.0 (d.v.)								
			Aug 5, 07	7.0 to 19.0 (d.v.)								
			Aug 6, 07	5.0 to 8.0 (d.v.)	10 19.3 W	.....	.....	10.1, 10.8	.21187	3	.....	HWF
			Jul 12, 07	.....	.....	14.6	67 15.7 N	.....	.....	..	172.1	HWF
			Jan 10, 10	15.4	10 46.0 W	.....	.....	15.9, 16.8	.21061	2	.....	C I
			Jan 11, 10	10.5, 12.4	10 44.5 W	.....	.....	11.1, 12.0	.21058	2	.....	C I
			Jan 11, 10	13.9, 16.2, 16.7	10 46.0 W	.....	.....	14.5, 15.7	.21062	4	.....	C I
			Jan 12, 10	.....	.....	10.4, 11.8	67 20.5 N	.....	.....	..	201.12	C I
Agar's Island, Secondary*	32 17.6 N	295 12	Jul 8, 07	.....	.....	15.0	67 16.8 N	16.0	*.21174*	*172*	172.12	HWF
			Aug 5, 07	9.6 to 16.6(5)	10 24.4 W	.....	.....	.....	.....	*172*	.....	HWF
Agar's Island, B*	32 17.6 N	295 12	Jan 10, 10	.....	.....	12.5	67 24.8 N	.....	.....	..	201.12	C I
			Jan 11, 10	10.6, 12.4	10 50.6 W	.....	.....	11.1, 12.0	.20960	4	.....	C I
			Jan 11, 10	13.9, 16.2, 16.7	10 52.6 W	.....	.....	.....	.....	2	.....	C I
			Jan 12, 10	.....	.....	13.7, 15.9	67 24.3 N	.....	.....	..	201.12	C I
			Jan 18, 10	9.9, 11.9	10 47.4 W	.....	.....	10.5, 11.4	.20979	4	.....	C I
Spectacle Island*	32 15.9 N	295 10	Jul 22, 07	13.1, 15.0	6 31.7 W	17.0	64 47.9 N	13.8, 14.7	.23499	3	172.12	HWF
			Jul 22, 07	.....	.....	.....	.....	17.6	*.23507*	*172*	.....	HWF
			Jan 22, 10	10.5	6 44.6 W	14.5, 16.3	64 56.8 N	11.3, 12.4	.23297	4	189.9,10	C I
Spectacle Island, B*	32 15.9 N	295 10	Jan 22, 10	14.2, 16.5	6 46.3 W	10.6, 12.2	64 56.4 N	14.7, 15.7	.23291	4	189.9,10	C I

MADEIRAS. –

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Funchal, A*	32 38 N	343 05	Nov 27,'09	14.2	20 24.9 W	15.3	53 52.2 N	15.4	*.25384*	*203*	203.56	C I
Funchal, B*	32 38 N	343 05	Nov 27, 09	14.3	20 23.6 W	15.3	53 52.4 N	15.4	*.25280*	*201*	201.12	C I
Funchal, C*	32 38 N	343 05	Nov 27, 09	10.4, 11.1	18 23.0 W	10.8	54 07.7 N	.....	.....	*203*	203.5	C I
Funchal, D*	32 38 N	343 05	Nov 27, 09	10.4, 11.1	17 00.3 W	10.8	54 13.0 N	.....	.....	*201*	201.1	C I

WEST INDIES.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Havana, College	23 08.2 N	277 38	May 22,'05	8.8, 14.0	2 57.1 E	10.1, 15.3	52 58.4 N	8.8, 14.0	.30244	19	171.12	JPA
			May 23, 05	8.9, 13.9	2 58.5 E	10.2, 15.2	52 58.8 N	8.9, 13.9	.30249	19	171.12	JPA
Havana, Villa	23 06.4 N	277 39	May 19, 05	10.1, 13.2, 14.6	2 58.5 E	11.0, 15.4	53 00.6 N	9.3, 13.9	.30283	19	171.12	JPA
			May 20, 05	8.9, 14.0	2 59.0 E	10.3, 15.4	52 59.1 N	8.9, 14.0	.30250	19	171.12	JPA
			May 25, 05	8.8, 13.7	2 59.4 E	10.0, 14.9	52 58.8 N	8.8, 13.7	.30264	19	171.12	JPA
			Dec 4, 08	12.7, 15.5	2 59.0 E	.....	.....	13.5, 14.8	.29943	7	.....	WHS
			Dec 5, 08	.....	.....	10.9	53 25.2 N	11.9	*.29866*	*172*	172.12	WHS
Matanzas, B	23 02.7 N	278 24	May 30, 05	10.2, 11.5	2 34.0 E	13.9	53 05.6 N	10.6, 11.2	.30054	19	171.12	JPA
Matanzas, A	23 02.5 N	278 25	May 29, 05	12.8, 14.4	2 26.0 E	11.1	52 58.1 N	13.2, 14.0	.30048	19	171.12	JPA
Cardenas	23 01.4 N	278 44	Dec 9, 08	9.2, 13.2, 15.4	2 28.7 E	.....	.....	10.0, 10.9	.29604	7	.....	WHS
			Dec 9, 08	.....	.....	.....	.....	13.7, 14.6	.29558	7	.....	WHS
			Dec 10, 08	11.7 to 12.6(4)	2 26.7 E	9.0	53 23.5 N	10.0	*.29579*	*172*	172.12	WHS
Sagua la Grande	22 48.6 N	279 49	Dec 18, 08	9.1 to 14.4(6)	2 11.4 E	.....	.....	9.8, 11.0	.29836	7	.....	WHS
			Dec 19, 08	.....	.....	9.2	53 12.5 N	10.3	*.29743*	*172*	172.12	WHS
			Dec 20, 08	9.1, 11.2	2 15.0 E	.....	.....	9.6, 10.1	.29819	7	.....	WHS
Macagua	22 44.7 N	279 10	Dec 15, 08	9.0, 11.0	2 16.7 E	13.4	53 05.0 N	9.6, 10.5	.29692	7	172.12	WHS
			Dec 15, 08	.....	.....	.....	.....	14.5	*.29725*	*172*	.....	WHS
Batabano	22 42.3 N	277 42	Jun 2, 05	13.0, 14.2	2 53.9 E	15.0	52 33.6 N	13.4, 13.9	.30270	19	171.12	JPA
Pinar del Rio	22 25.4 N	276 18	Jun 5, 05	.....	.....	16.1	51 56.3 N	.....	.....	..	171.12	JPA
			Jun 6, 05	8.8, 9.9	3 48.1 E	.....	.....	9.1, 9.6	.30526	19	.....	JPA
Placetas	22 21.1 N	280 21	Dec 30, 08	13.7, 15.9	1 01.2 E	.....	.....	14.3, 15.3	.29377	7	.....	WHS
			Dec 31, 08	.....	.....	9.6	53 04.1 N	10.6	*.29345*	*172*	172.12	WHS

* Local disturbance.

ISLANDS, ATLANTIC OCEAN.

WEST INDIES—*Continued.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h b h	° ′	h h	° ′	h h	Γ			
Placetas, A	22 18.3 N	280 19	Jan 2,'09	8.9, 11.2	3 04.9 E	.....	.....	9.5, 10.6	.28649	7	.....	WHS
			Jan 2, 09	.....	.....	13.7	53 44.5 N	14.7	*.28594*	*172*	172.12	WHS
			Jan 4, 09	9.5, 11.6, 16.4	3 00.4 E	.....	.....	10.0, 10.9	.28622	7	.....	WHS
			Jan 4, 09	.....	.....	13.7	53 46.4 N	14.6	*.28558*	*172*	172.12	WHS
Yaguaramas	22 17.8 N	279 12	Dec 12, 08	9.2, 11.2	2 40.0 E	13.4	52 55.7 N	9.6, 10.5	.29598	7	172.12	WHS
			Dec 12, 08	.....	.....	.....	.....	14.4	*.29590*	*172*	.....	WHS
Cienfuegos	22 08.7 N	279 31	Dec 21, 08	9.1, 11.0	2 05.8 E	.....	.....	9.6, 10.5	.29816	7	.....	WHS
			Dec 21, 08	14.0	2 03.4 E	13.4	52 43.9 N	14.4	*.29745*	*172*	172.12	WHS
			Dec 25, 08	13.1	2 01.0 E	12.6	52 44.5 N	13.6	*.29751*	*172*	172.12	WHS
			Dec 28, 08	15.8	2 04.8 E	15.2	52 38.9 N	16.4	*.29818*	*172*	172.12	WHS
Jucaro	21 37.1 N	281 04	Jan 7, 09	13.0, 15.7	1 40.0 E	.....	.....	13.6, 14.9	.29876	7	.....	WHS
			Jan 8, 09	9.1, 11.3	1 40.9 E	12.6	52 23.5 N	9.6, 10.7	.29925	7	172.12	WHS
			Jan 8, 09	.....	.....	.....	.....	13.5	*.29805*	*172*	.....	WHS
Nuevitas	21 35.2 N	282 46	Jan 25, 09	9.2, 11.3	1 11.0 E	13.6	52 07.6 N	9.8, 10.7	.29782	7	172.12	WHS
			Jan 26, 09	.....	.....	8.4	52 07.6 N	.....	.....	..	172.12	WHS
Gibara	21 08.9 N	283 52	Jan 28, 09	13.0, 14.9	0 50.7 E	9.7	51 24.0 N	13.5, 14.4	.29892	7	172.12	WHS
			Jan 28, 09	.....	.....	.....	.....	10.8	*.29974*	*172*	.....	WHS
Santa Cruz	20 42.7 N	282 03	Jan 9, 09	.....	.....	13.6	50 51.5 N	.....	.....	..	172.12	WHS
			Jan 10, 09	10.0, 12.9	1 35.0 E	14.5	50 48.5 N	10.6, 11.9	.30279	7	172.12	WHS
			Jan 10, 09	.....	.....	.....	.....	15.4	*.30289*	*172*	.....	WHS
Guayabal	20 41.0 N	282 24	Jan 12, 09	9.5, 11.4	1 54.6 E	13.7	50 38.1 N	10.0, 10.9	.30206	7	172.12	WHS
			Jan 12, 09	.....	.....	.....	.....	14.7	*.30240*	*172*	.....	WHS
Manzanillo	20 22.4 N	282 54	Jan 14, 09	9.3, 11.2	1 19.6 E	13.7	50 33.9 N	9.9, 10.7	.30266	7	172.12	WHS
			Jan 14, 09	.....	.....	.....	.....	14.7	*.30256*	*172*	.....	WHS
			Jan 16, 09	.....	.....	15.5	50 35.4 N	.....	.....	..	172.12	WHS
Santiago, Raja Yoga	20 00.5 N	284 13	Jan 18, 09	14.4, 16.4	0 52.6 E	.....	.....	14.9, 15.9	.29958	7	.....	WHS
Santiago, San Juan Hill	20 00.5 N	284 13	Jan 20, 09	14.2, 17.5	1 40.6 E	.....	.....	16.3, 17.0	.29870	7	.....	WHS
			Jan 21, 09	.....	.....	10.0, 13.9	50 48.3 N	11.1, 14.8	*.29896*	*172*	172.12	WHS
San Juan, A	18 27.5 N	293 52	Mar 25, 05	.....	.....	.....	.....	12.0, 13.0	.29264	17	.....	DCS
San Juan, C	18 27.3 N	293 52	Sep 23, 05	12.4, 13.9	1 30.2 W	11.0	50 04.2 N	12.9, 13.5	.29182	17	18.(56)	DCS
			Sep 23, 05	.....	.....	15.2	50 03.7 N	14.4	.29191	17	18.(6)	DCS
San Juan, B	18 26 N	293 52	Mar 27, 05	.....	.....	12.1	49 53.7 N	12.5	*.29431*	*84*	34.12	DCS
Charlotte Amelia	18 21.0 N	295 06	May 29, 05	12.9, 15.2	1 47.2 W	17.0(wt.½)	49 23.4 N	14 4, 15.8	.29418	17	18.4	DCS
			May 30, 05	10.2, 11.6	1 48.2 W	13.6, 17.2	49 21.1 N	10.6, 11.3	.29463	17	18.4	DCS
			May 31, 05	.....	.....	10.5	49 21.2 N	.....	.....	..	18.4	DCS
Scorpion Point	18 18.2 N	294 41	Aug 6, 10	10.2, 12.7	2 54.0 W	13.9, 17.1	50 26.7 N	10.7, 12.3	.28450	4	201.12	C H
Crocus Bay	18 13.5 N	296 57	Jun 6, 05	.....	.....	16.9, 17.2	49 46.8 N	.....	.....	..	18.4	DCS
			Jun 7, 05	9.4, 10.1	2 53.9 W	.....	.....	10.0, 10.7	.29106	17	.....	DCS
Vieques, Old Absolute Observatory	18 08.9 N	294 34	Mar 30, 05	9.6, 11.3	1 23.8 W	.....	.....	10.2, 10.9	.29033	17	.....	DCS
			Mar 30, 05	13.5, 15.9	1 25.4 W	.....	.....	14.2, 15.4	.29017	17	.....	DCS
			Mar 31, 05	.....	.....	16.5	49 42.7 N	.....	.....	..	18.4	DCS
			Apr 1 to Apr 27, 05	9.0 to 11.9(8)	1 22.7 W	Various(6)	49 41.0 N	9.7 to 11.5(10)	.29013	17	18.4	DCS
			May 23, 05	.....	.....	.....	.....	14.7, 15.4	.29018	17	.....	DCS
			Sep 14, 05	14.8, 16.4	1 30.0 W	.....	.....	15.2, 15.9	.28968	17	.....	DCS
			Sep 15, 05	.....	.....	10.1	49 39.6 N	.....	.....	..	18.(56)	DCS
			Sep 16, 05	10.3, 14.8(wt.4)	1 28.4 W	.....	.....	10.3, 14.8	.28980	17	.....	DCS
			Sep 18, 05	15.6, 16.9	1 29.6 W	10.1	49 40.2 N	15.9, 16.6	.28992	17	18.(56)	DCS
			Sep 19, 05	.....	.....	7.8, 16.8	49 42.2 N	.....	.....	..	18.(56)	DCS
			Sep 20, 05	.....	.....	7.3	49 42.8 N	.....	.....	..	18.(56)	DCS
			Sep 21, 05	.....	.....	7.8	49 43.4 N	.....	.....	..	18.(56)	DCS
Vieques Observatory, A	18 08.9 N	294 34	Apr 7 to Apr 28, 05	.....	.....	Mean of 6 sets, 11.0	49 37.7 N	.....	.....	..	18.4	DCS
			May 1 to May 22, 05	.....	.....	Mean of 6 sets, 11.3	49 39.3 N	.....	.....	..	18.4	DCS
Vieques, New Absolute Observatory	18 08.8 N	294 33	Jul 26, 10	.....	.....	10.9, 11.6	49 52.8 N	.....	.....	..	201.12	C H
			Jul 26, 10	.....	.....	14.2	49 54.1 N	.....	.....	..	201.12	C H
			Jul 29, 10	10.0, 14.2, 16.2	2 21.9 W	.....	.....	11.0, 15.2	.28836	4	. .....	C H
			Jul 30, 10	9.6, 11.4	2 20.4 W	.....	.....	10.2, 10.9	.28816	2	.....	C H
			Jul 30, 10	13.4, 15.0	2 23.1 W	.....	.....	13.8, 14.5	.28835	2	.....	C H
Vieques, 1	18 08.8 N	294 33	Jul 27, 10	.....	.....	10.3, 10.9	50 00.0 N	.....	.....	..	201.12	C H
			Jul 27, 10	.....	.....	11.6	50 00.8 N	.....	.....	..	201.12	C H
			Jul 28, 10	9.9, 11.8	2 24.2 W	.....	.....	10.6, 11.4	.28848	2	.....	C H
			Jul 28, 10	13.7, 15.4	2 25.2 W	.....	.....	14.2, 15.0	.28831	2	.....	C H
			Jul 30, 10	9.6, 11.4	2 22.4 W	.....	.....	10.6	.28808	4	.....	C H
			Jul 30, 10	13.3, 15.0	2 24.6 W	.....	.....	14.2	.28797	4	.....	C H

ISLANDS, ATLANTIC OCEAN.

WEST INDIES—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Vieques, 2	18 08.8 N	294 33	Jul 28,'10	9.9, 11.9	2 24.0 W	.....	.....	10.6, 11.4	.28794	4	.....	C H
			Jul 28, 10	13.7, 15.4	2 24.7 W	.....	.....	14.6	.28781	4	.....	C H
			Jul 29, 10	10.0, 11.9	2 22.0 W	.....	.....	10.6, 11.4	.28788	2	.....	C H
			Jul 29, 10	14.2, 16.2	2 24.2 W	.....	.....	14.8, 15.6	.28750	2	.....	C H
Philipsburg	18 01.3 N	296 57	Jun 5, 05	9.4, 11.2	2 11.4 W	13.3, 13.6	49 26.9 N	10.6, 11.0	.28963	17	18.4	DCS
Kingston, Jamaica	17 58.9 N	283 11	Mar 8, 05	15.3	1 27.1 E	13.9	47 21.2 N	.....	.....	19	171.12	JPA
			Mar 9, 05	13.9, 15.4	1 26.2 E	.....	.....	14.4, 15.1	.31262	19	.....	JPA
			Mar 9, 05	.....	.....	.....	.....	16.0, 16.7	.31230	19	.....	JPA
			May 6, 05	8.2, 9.8	1 33.4 E	10.5	47 22.0 N	8.7, 9.4	.31273	19	171.12	JPA
			Jul 17, 08	6.5, 8.5	1 18.5 E	7.5	47 54.7 N	7.6	*.30818*	*178*	178.1	EK
Christiansted	17 44.3 N	295 19	Jun 10, 05	15.3, 16.9, 17.2	2 16.9 W	12.4	48 53.0 N	15.8, 16.5	.29285	17	18.4	DCS
Codrington	17 39.5 N	298 15	Jun 23, 05	12.7, 15.0	3 33.6 W	16.8	49 21.2 N	13.2, 14.5	.28820	17	18.4	DCS
Basse Terre, St. Christopher	17 18.4 N	297 18	Jun 14, 05	13.1, 14.8	3 11.4 W	11.1	48 23.2 N	13.6, 14.3	.29582	17	18.4	DCS
			Jun 15, 05	12.6, 13.7	3 09.4 W	.....	.....	13.1	.29603	17	.....	DCS
Charlestown	17 08.6 N	297 25	Jun 16, 05	13.0, 14.7	2 26.7 W	11.4, 15.9	48 32.1 N	13.7, 14.3	.29110	17	18.4	DCS
St. Johns	17 07.5 N	298 13	Jun 21, 05	14.5, 16.4	3 21.4 W	12.9	48 41.2 N	15.0, 15.8	.28894	17	18.4	DCS
			Jun 22, 05	10.0, 11.5	3 18.3 W	7.7	48 43.1 N	10.4, 11.1	.28905	17	18.4	DCS
Plymouth	16 42.3 N	297 48	Jun 27, 05	12.8, 14.2	2 38.2 W	16.5	48 06.4 N	13.2, 13.9	.29197	17	18.4	DCS
			Jun 27, 05	.....	.....	.....	.....	14.3, 14.9	.29162	17	.....	DCS
Le Moule	16 20.7 N	298 44	Jul 6, 05	.....	.....	14.0	47 27.3 N	.....	.....	..	18.(56)	DCS
			Jul 7, 05	9.3, 10.9	2 58.5 W	.....	.....	9.8, 10.5	.29524	17	.....	DCS
Pointe à Pitre	16 14.4 N	298 31	Jul 4, 05	.....	.....	17.4	47 14.2 N	.....	.....	..	18.(56)	DCS
			Jul 5, 05	10.0, 12.5	2 44.6 W	.....	.....	10.4, 11.2	.29669	17	.....	DCS
			Jul 8, 05	.....	.....	.....	.....	10.6, 11.2	.29648	17	.....	DCS
Basse Terre, Guadeloupe	15 59.8 N	298 19	Jun 30, 05	9.5, 11.1	1 45.8 W	15.7	47 51.2 N	10.0, 10.7	.29365	17	18.(56)	DCS
			Jul 3, 05	15.1, 15.8	1 50.0 W	.....	.....	.....	.....	17	.....	DCS
Grand Bourg	15 52.5 N	298 44	Jul 10, 05	.....	.....	13.7, 16.5	47 28.6 N	.....	.....	..	18.(56)	DCS
			Jul 11, 05	9.6, 11.0	2 39.3 W	.....	.....	10.0, 10.6	.29254	17	.....	DCS
Roseau	15 18.0 N	298 37	Jul 19, 05	9.8, 11.3	3 04.3 W	13.0	46 19.0 N	10.2, 10.9	.29475	17	18.(56)	DCS
Fort de France	14 35.9 N	298 54	Jul 21, 05	15.1, 16.6	2 22.0 W	11.2, 11.5	45 14.6 N	15.5, 16.2	.29620	17	18.(56)	DCS
			Jul 22, 05	8.8, 10.4	2 18.0 W	.....	.....	9.3, 10.0	.29636	17	.....	DCS
Port Castries	14 01.1 N	299 03	Jul 27, 05	12.8, 14.4	2 03.8 W	15.8	45 24.0 N	13.2, 13.9	.29496	17	18.(56)	DCS
Bathsheba	13 13 N	300 29	Aug 3, 08	10.6, 12.2	3 33.5 W	14.7	44 06.6 N	11.0, 11.8	.29520	4	189.36	HWF
Kingston, St. Vincent	13 09.2 N	298 48	Aug 2, 05	10.0, 11.4	1 43.6 W	16.1	43 39.0 N	10.4, 11.0	.29724	17	18.(56)	DCS
			Aug 3, 05	8.2, 9.5	1 39.9 W	.....	.....	8.6, 9.2	.29792	17	.....	DCS
Bridgetown	13 04.8 N	300 21	Jul 30, 05	16.0, 17.4	2 58.6 W	10.7	43 37.2 N	16.4, 17.0	.29656	17	18.(56)	DCS
			Jul 31, 05	7.2, 8.6	2 54.6 W	10.2	43 37.4 N	7.6, 8.2	.29678	17	18.(56)	DCS
			Jul 29, 08	15.0, 16.1	3 30.3 W	.....	.....	16.6, 17.3	.29489	4	.....	HWF
			Jul 30, 08	9.6, 11.4	3 30.4 W	15.7, 17.6	44 01.6 N	10.2, 11.1	.29536	4	189.569, 10	HWF
			Jul 31, 08	.....	.....	16.0	44 05.5 N	.....	.....	..	189.6	HWF
St. George	12 02.8 N	298 16	Aug 5, 05	14.9, 16.6	3 22.9 W	.....	.....	15.3, 16.0	.29783	17	.....	DCS
			Aug 7, 05	.....	.....	8.2	41 33.8 N	10.4, 11.1	.29837	17	18.(56)	DCS
Scarborough	11 11.3 N	299 14	Aug 15, 05	12.8, 14.2	1 51.0 W	10.6	40 30.4 N	13.2, 13.8	.30321	17	18.(56)	DCS
Port of Spain	10 40.6 N	298 28	Aug 10, 05	12.6, 14.0	1 17.6 W	10.0	39 49.2 N	13.3, 16.5	.30419	17	18.(56)	DCS
			Aug 11, 05	8.8, 10.1	1 13.6 W	12.8	39 50.6 N	9.2, 9.8	.30434	17	18.(56)	DCS
			Dec 9, 08	8.0, 9.0	1 52.8 W	8.4	40 10.5 N	8.4	*.30333*	*189*	189.3	HWF
Sangre Grande	10 34.2 N	298 52	Aug 18, 05	12.9, 14.7	1 25.9 W	16.2	39 47.9 N	13.4, 14.2	.30306	17	18.(56)	DCS
San Fernando	10 17.0 N	298 31	Aug 21, 05	16.1, 17.6	1 12.0 W	.....	.....	16.6, 17.2	.30296	17	.....	DCS
			Aug 22, 05	.....	.....	8.2	39 16.6 N	.....	.....	..	18.(56)	DCS
			Aug 23, 05	.....	.....	8.3	39 17.2 N	.....	.....	..	18.(56)	DCS
			Aug 24, 05	12.9, 14.6	1 11.6 W	15.9	39 19.8 N	13.3, 14.1	.30312	17	18 (56)	DCS

ISLANDS, PACIFIC OCEAN.

CAROLINE ISLANDS.

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Yap Island	9 31.4 N	138 12	Apr 17,'07	12.0, 13.0	2 03.4 E	16.9	6 15.5 N	12.3, 12.7	.36816	1	35.12	G III
			Apr 17, 07	14.4	2 01.1 E	.....	.....	.....	.....	*35*	.....	G III
			Apr 18, 07	12.6	2 02.9 E	10.3	6 10.0 N	.....	.....	*35*	178.12	G III
			Apr 18, 07	.....	.....	13.5, 14.9	6 08.9 N	.....	.....	..	35.12	G III
			Apr 18, 07	.....	.....	15.6	6 05.2 N	.....	.....	..	35.12	G III
Yap Island, W	9 31.4 N	138 12	Apr 16, 07	11.4	2 03.7 E	14.7	6 12.7 N	.....	.....	1	178.12	G III
			Apr 17, 07	6.6	2 04.2 E	10.4	6 11.5 N	.....	.....	*35*	35.12	G III
			Apr 17, 07	.....	.....	12.9	6 08.8 N	.....	.....	..	169.12	G III
			Apr 18, 07	.....	.....	10.3	6 09.2 N	.....	.....	..	169.12	G III
Yap Island, E	9 31.4 N	138 12	Apr 16, 07	11.9, 12.6, 13.3	2 04.9 E	.....	.....	14.5, 15.0	.36744	1	.....	G III
			Apr 17, 07	.....	.....	12.3	6 08.1 N	.....	.....	..	178.12	G III
			Apr 18, 07	9.5, 10.4	2 06.2 E	16.4	6 09.8 N	9.7, 10.1	.36771	1	169.12	G III

COOK ISLANDS.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Arutanga	18 52.5 S	200 14	Oct 15,'06	10.1, 11.6	10 39.4 E	8.8	34 19.7 S	10.9	.33860	2025	171.(56)	GII
Avarua	21 12.0 S	200 14	Oct 18, 06	10.3, 11.9	10 36.8 E	14.2	38 19.6 S	11.1	.33164	2025	171.(56)	GH

FANNING ISLAND.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Fanning Island	3 54.5 N	200 37	Oct 11,'05	10.4, 12.2	7 39.5 E	15.7	10 47.2 N	10.8, 11.8	.34124	36	171.12	G I
			Apr 2, 06	14.1, 15.8	7 43.8 E	.....	.....	14.6, 15.4	.34087	36	.....	G II
			Apr 3, 06	14.6, 16.2	7 44.4 E	.....	.....	15.0, 15.8	.34093	36	.....	G II
			Apr 5, 06	.....	.....	12.4	10 45.6 N	.....	.....	..	178.12	G II
Fanning Island, Secondary	3 54.5 N	200 37	Apr 2, 06	.....	.....	16.8	10 49.4 N	.....	.....	..	178.12	G II
			Apr 3, 06	.....	.....	13.4	10 48.6 N	.....	.....	..	178.12	G II
			Apr 5, 06	10.3, 14.5	7 43.7 E	.....	.....	10.8, 14.2	.34100	36	178.12	G II

FIJI ISLANDS.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Oinafa	12 29.3 S	177 08	May 1,'06	7.5, 16.1	9 34.2 E	15.1	28 51.6 S	11.7	.36095	2025	25.79	GII
Tilingitha Island	16 10.7 S	179 47	May 4, 06	8.9, 15.0	10 15.0 E	13.8	34 25.0 S	11.8	.35539	2025	25.79	GH
Levuka, Vagadace	17 40.5 S	178 51	Jun 6, 06	8.3, 14.5	10 07.0 E	15.8	37 45.8 S	11.5	.34390	2025	171.12	GH
			Jun 7, 06	.....	.....	.....	.....	11.2(wt.½)	*.34479*	*171*	.....	GII
Levuka, Niakombi Point	17 40.8 S	178 51	Jun 4, 06	16.6	10 29.3 E	15.3	39 05.5 S	.....	.....	2025	171.12	GH
			Jun 5, 06	9.4	10 28.5 E	.....	.....	10.7	.33411	2025	.....	GH
Suva Vou	18 07.1 S	178 25	May 20, 06	11.0, 12.6	10 28.4 E	.....	.....	11.3, 12.3	.34868	36	.....	G II
			May 20, 06	16.6	10 30.4 E	.....	.....	15.2	.34852	2025	.....	GH
			May 26, 06	14.4	10 30.7 E	13.3	38 07.8 S	.....	.....	2025	171.12	GH
Suva Vou, B	18 07.1 S	178 25	May 20, 06	.....	.....	11.4	38 04.9 S	.....	.....	...	171.12	G II
Suva, Base Station	18 07.6 S	178 26	May 14, 06	10.1, 12.2, 15.9	10 27.3 E	.....	.....	.....	.....	2025	.....	GH
			May 15, 06	.....	.....	.....	.....	12.2, 14.6	.34743	2025	.....	GH
			May 16, 06	.....	.....	.....	.....	9.9	.34694	2025	.....	GH
			May 28, 06	.....	.....	10.7	38 24.0 S	.....	.....	....	171.12	GII
			May 29, 06	9.1, 15.6	10 26.2 E	16.4	38 23.7 S	.....	.....	*171*	171.12	GH
Suva, Hospital Hill	18 07.7 S	178 26	Apr 13, 06	10.0	10 25.9 E	14.2	38 12.5 S	12.2	.34790	2025	25.79	GH
			Apr 21, 06	11.6	10 28.9 E	.....	.....	.....	.....	2025	.....	GH
			Jun 14, 06	.....	.....	9.5	38 11.8 S	.....	.....	....	171.12	GH
Suva, Dr. Klotz' station	18 08.8 S	178 26	Apr 5, 06	16.2	10 23.7 E	.....	.....	14.5	.35108	2025	.....	GII
			Apr 6, 06	9.6	10 21.0 E	13.9	37 45.8 S	.....	.....	2025	25.79	GII
			Apr 11, 06	.....	.....	9.2	37 46.2 S	.....	.....	....	25.79	GII
			May 10, 06	8.4 to 17 0 (d.v.)	10 21.2 E	.....	.....	.....	.....	2025	.....	GH
			Jun 14, 06	.....	.....	12.4	37 45.1 S	.....	.....	....	171.12	GII
Nukulau Island	18 10.5 S	178 31	May 31, 06	16.6	10 34.3 E	.....	.....	.....	.....	2025	.....	GII
			Jun 1, 06	10.6	10 32.4 E	7.3	38 02.6 S	11.6	.34762	2025	171.12	GII
			Jun 1, 06	.....	.....	.....	.....	8.8(wt.½)	*.3488*	*171*	.....	GII

HAWAIIAN ISLANDS.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Sisal, Honolulu Magnetic Observatory	21 19.2 N	201 56	Sep 19,'05	9.0, 11.0	9 23.4 E	14.3	40 04.2 N	9.6, 10.6	.29176	36	169.12	G I
			Sep 19, 05	.....	.....	15.4(wt.2)	40 08.2 N	.....	.....	..	171.12	G I
			Sep 21, 05	.....	.....	10.5	40 02.0 N	.....	.....	..	169.12	G I
			Nov 8, 05	.....	.....	13.9, 15.4	40 05.0 N	.....	.....	..	169.12	G I
			Sep 3, 07	.....	.....	16.0	40 00.7 N	.....	.....	..	169.12	G III

ISLANDS, PACIFIC OCEAN.

HAWAIIAN ISLANDS—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Sisal, Honolulu Magnetic Observatory	21 19.2 N	201 56	Sep 4,'07	13.9, 15.6	9 22.9 E	14.0	40 01.7 N	14.7, 16.4	.29163	4	169.12	G III
			Sep 6, 07	10.0, 13.4, 15.0	9 25.6 E	.....	.....	10.8, 14.1	.29163	4	.....	G III
			Sep 7, 07	9.5, 11.1, 14.7	9 23.9 E	.....	.....	10.1, 13.9	.29172	4	.....	G III
			Sep 9, 07	.....	.....	.....	.....	11.2, 13.7	.29176	4	.....	G III
Sisal, A	21 19.2 N	201 56	Sep 3, 07	.....	.....	14.4(wt.½)	39 55.7 N	.....	.....	..	189.56	G III
			Sep 4, 07	.....	.....	8.9(wt.½)	40 00.3 N	.....	.....	..	169.12	G III
			Sep 5, 07	10.3, 14.5, 16.1	9 25.1 E	9.0, 15.3	39 57.6 N	11.1, 13.9	.29167	4	178.12	G III
			Sep 6, 07	.....	.....	8.9, 15.8	39 56.8 N	.....	.....	..	178.12	G III
			Sep 9, 07	13.1, 14.5	9 23.2 E	.....	.....	.....	.....	4	.....	G III
Sisal, B	21 19.2 N	201 56	Sep 4, 07	.....	.....	15.8	39 55.8 N	.....	.....	..	189.56	G III
			Sep 6, 07	.....	.....	10.7, 13.8	39 55.0 N	.....	.....	..	189.56	G III

LADRONE ISLANDS.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Guam, Cabras Island	13 28 N	144 40	Jul 16,'06	10.8, 12.6	2 14.8 E	14.4	14 15.0 N	11.5, 12.3	.34990	36	178.56	G II
Guam, Cabras Island, Secondary	13 28 N	144 40	Jul 16, 06	.....	.....	11.1	14 20.9 N	.....	.....	..	35.25	G II
Guam, Orote Point	13 27 N	144 37	Jul 17, 06	10.7, 12.0	2 11.6 E	14.3	14 14.7 N	11.0, 11.7	.35007	36	178.56	G II
			Jul 19, 06	.....	.....	10.7(wt.½)	14 16.0 N	.....	.....	..	35.25	G II
Guam, Orote Point, Secondary	13 27 N	144 37	Jul 17, 06	.....	.....	11.4(wt.½)	14 18.4 N	.....	.....	..	35.25	G II
			Jul 19, 06	9.9, 11.3	2 11.1 E	14.0	14 14.8 N	10.3, 11.0	.35028	36	178.56	G II

MARQUESAS ISLANDS.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Nukahiva Island, 8*	8 54 S	219 55	Jan 19,'07	10.4, 11.8	8 13.4 E	15.1	13 34.8 S	10.8, 11.4	.34222	1	178.12	G III
			Jan 21, 07	.....	.....	11.1, 14.4	13 35.8 S	.....	.....	..	35.12	G III
Nukahiva Island, S_1*	8 54 S	219 55	Jan 19, 07	14.9, 16.0	8 21.2 E	13.0	14 38.7 S	15.3, 15.7	.34444	1	178.12	G III
Nukahiva Island, 8_2*	8 54 S	219 55	Jan 19, 07	14.2, 12.4	7 20.0 E	10.7	15 28.6 S	13.0, 13.8	.33460	1	178.12	G III
Nukahiva Island, 9	8 54 S	219 54	Jan 23, 07	11.0, 12.4	8 19.0 E	15.6	15 19.4 S	11.4, 12.0	.33505	1	178.12	G III
			Jan 23, 07	13.2, 14.4	8 19.9 E	.....	.....	13.6, 14.1	.33468	1	.....	G III
Nukahiva Island, 9_1	8 54 S	219 54	Jan 22, 07	11.0, 11.5	8 18.7 E	.....	.....	.....	.....	1	.....	G III
Nukahiva Island, 9_2	8 54 S	219 54	Jan 22, 07	12.3	8 20.6 E	.....	.....	.....	.....	1	.....	G III

MARSHALL ISLANDS.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Jaluit Island	5 54.4 N	169 39	Jun 22,'06	10.5, 10.8, 12.9	8 17.1 E	.....	.....	11.4, 12.2	.34421	36	.....	G II
			Jun 25, 06	.....	.....	10.8, 15.0	6 11.0 N	.....	.....	..	35.25	G II
			Jun 26, 06	.....	.....	14.5	6 11.0 N	.....	.....	..	178.56	G II
			Oct 23, 07	13.8, 16.2	8 15.4 E	16.7	6 11.0 N	14.9	.34374	4	178.12	G III
			Oct 24, 07	14.5, 16.8	8 16.6 E	15.0, 16.4	6 05.6 N	15.2, 16.3	.34397	4	169.12	G III
			Oct 25, 07	.....	.....	14.9	6 05.1 N	.....	.....	..	169.12	G III
Jaluit Island, Secondary	5 54.4 N	169 39	Jun 22, 06	.....	.....	15.6	6 14.0 N	.....	.....	..	178.12	G II
			Jun 25, 06	11.4, 15.5	8 17.4 E	.....	.....	14.1, 15.0	.34448	36	.....	G II
			Jun 29, 06	.....	.....	8.9	6 13.1 N	.....	.....	..	35.25	G II
Jaluit Island, Secondary 2	5 54.4 N	169 39	Oct 23, 07	14.1	8 13.9 E	11.4, 13.1	6 09.2 N	.....	.....	*178*	178.12	G III
Jaluit Island, III	5 52.9 N	169 36	Jun 29, 06	10.0	8 21.4 E	.....	.....	10.4	.34664	36	.....	G II
Jaluit Island, III, Secondary	5 52.9 N	169 36	Jun 29, 06	.....	.....	10.4	6 08.4 N	.....	.....	..	178.6	G II

SAMOAN ISLANDS.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Apia, Observatory	13 48.4 S	188 14	Dec 13 '05	10.4	9 33.9 E	.....	.....	.....	.....	2025	.....	GH
			Jan 4, 06	11.5	9 37.7 E	.....	.....	.....	.....	2025	.....	GH
			Jan 30, 06	9.7	9 35.3 E	.....	.....	.....	.....	2025	.....	GH
			Feb 14, 06	.....	.....	.....	.....	14.2	.35732	2025	.....	GH
			Feb 16, 06	.....	.....	.....	.....	14.6	.35704	2025	.....	GH
			Feb 18, 06	.....	.....	.....	.....	9.4	.35703	2025	.....	GH
			Feb 19, 06	.....	.....	.....	.....	9.9	.35663	2025	.....	GH
			Feb 22, 06	.....	.....	.....	.....	14.5	.35702	2025	.....	GH
			Feb 23, 06	.....	.....	.....	.....	9.8, 11.2	.35736	2025	.....	GH
			Mar 12, 06	10.8, 15.1	9 39.3 E	.....	.....	.....	.....	2025	.....	GH
			Mar 13, 06	.....	.....	13.0, 14.5	29 13.9 S	.....	.....	....	25.79	GH

* Local disturbance.

ISLANDS, PACIFIC OCEAN.

SAMOAN ISLANDS—*Concluded.*

Station	Latitude	Long. East of Gr.	Date	Declination		Inclination		Hor. Intensity		Instruments		Obs'r
				Local Mean Time	Value	L. M. T.	Value	L. M. T.	Value	Mag'r	Dip Circle	
	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Apia, Observatory	13 48.4 S	188 14	May 3,'06	8.6, 10.5	9 36.5 E	17.0	29 15.7 S	9.0, 10.0	.35699	36	171.12	G II
			May 4, 06	.....	.....	8.2	29 13.5 S	.....	.....	....	171.12	G II
			May 8, 06	.....	.....	9.5	29 12.2 S	.....	.....	....	171.12	G II
			Dec 8, 06	14.3	9 42.4 E	15.7	29 16.8 S	.....	.....	2025	171.(56)	GH
			Dec 9, 06	11.0	9 38.8 E	10.2	29 15.6 S	.....	.....	2025	171.(56)	GH
			Dec 10, 06	15.3	9 42.7 E	11.6	29 13.8 S	9.2	.35634	2025	171.(56)	GH
			Dec 11, 06	.....	.....	.....	.....	8.9, 15.3	.35632	2025	.....	GH
			Dec 12, 06	.....	.....	.....	.....	11.1	.35645	2025	.....	GH
			Dec 13, 06	12.9	9 40.3 E	10.8	29 13.8 S	13.9	.35652	2025	171.(56)	GH
			Dec 14, 06	13.1	9 39.9 E	.....	.....	.....	.....	2025	.....	GH
Apia, North Pier	13 48.4 S	188 14	May 3, 06	.....	.....	9.0, 16.9	29 15.6 S	.....	.....	....	178.1256	G II
			May 4, 06	.....	.....	8.4, 9.4	29 14.4 S	.....	.....	....	178.1256	G II
Apia, East Pier	13 48.4 S	188 14	May 3, 06	.....	.....	8.8, 15.9	29 13.4 S	.....	.....	....	35.25	G II
			May 4, 06	.....	.....	8.5	29 14.8 S	.....	.....	....	35.25	G II
			May 4, 06	.....	.....	16.1, 17.2	29 12.7 S	.....	.....	....	178.1256	G II
Apia, Stump	13 48.4 S	188 14	Mar 5, 07	.....	.....	11.8, 12.6	29 16.2 S	.....	.....	....	178.12	G III
			Mar 6, 07	10.8, 11.8	9 36.0 E	14.4	29 16.4 S	11.1, 11.5	.35632	1	178.12	G III
			Mar 6, 07	.....	.....	15.9, 17.2	29 15.0 S	.....	.....	....	35.12	G III
			Mar 7, 07	14.6, 15.6	9 38.0 E	11.8	29 15.6 S	14.9, 15.3	.35678	1	178.12	G III
			Mar 7, 07	.....	.....	13.6	29 13.4 S	.....	.....	....	35.12	G III
			Mar 7, 07	.....	.....	9.6, 10.8	29 12.7 S	.....	.....	....	169.12	G III
Apia, West Pier	13 48.4 S	188 14	Mar 5, 07	13.6, 14.6	9 33.2 E	11.4	29 12.2 S	13.9, 14.3	.35636	1	35.12	G III
			Mar 5, 07	.....	.....	15.9	29 11.0 S	.....	.....	....	169.12	G III
			Mar 5, 07	.....	.....	17.1	29 15.4 S	.....	.....	....	178.12	G III
			Mar 6, 07	8.3, 15.1	9 42.9 E	9.1	29 16.3 S	.....	.....	*35*	169.12	G III
			Mar 7, 07	.....	.....	14.5	29 15.3 S	.....	.....	....	169.12	G III

SOCIETY ISLANDS.

	° ′	° ′		h h h	° ′	h h	° ′	h b	Γ			
Vincennes Point	17 29.4 S	210 08	Oct 8,'06	9.4, 10.9	9 31.6 E	13.2	30 04.7 S	10.2	.34545	2025	171.(56)	GH
Point Fareute	17 31.2 S	210 27	Oct 3, 06	11.1, 15.2	9 00.0 E	9.8	30 38.8 S	13.4	.32476	2025	171.(56)	GH
Motu Uta*	17 31.6 S	210 26	Feb 6, 07	9.8	9 40.1 E	.....	.....	.....	.....	1	.....	G III
Motu Uta, 1*	17 31.6 S	210 26	Feb 6, 07	11.0	9 50.9 E	.....	.....	11.5	.33459	1	.....	G III
Papeete*	17 31.8 S	210 27	Aug 28, 06	14.5	7 35.2 E	10.4	30 30.8 S	.....	.....	2025	171.(56)	GH
			Aug 29, 06	13.8, 16.6	7 38.6 E	.....	.....	.....	.....	2025	.....	GH
			Aug 30, 06	.....	.....	15.5	30 31.0 S	9.5	.33761	2025	171.(56)	GH
			Oct 6, 06	7.5 to 16.5 (d.v.)	7 34.5 E	.....	.....	.....	.....	2025	.....	GH
			Feb 2, 07	10.6, 12.1	7 40.2 E	14.1	30 22.3 S	11.1, 11.8	.33758	1	178.12	G III
Papeete, Secondary*	17 31.8 S	210 27	Feb 2, 07	13.2, 14.6	7 50.8 E	11.7	29 48.4 S	13.6, 14.3	.33756	1	178.12	G III
Small Coral Island*	17 32 S	210 25	Feb 6, 07	15.2	9 37.3 E	.....	.....	.....	.....	1	.....	G III
			Feb 7, 07	11.1	9 38.1 E	14.5	29 25.6 S	.....	.....	1	178.12	G III
			Feb 8, 07	.....	.....	11.5	29 25.8 S	.....	.....	....	169.12	G III
			Feb 8, 07	.....	.....	14.3	29 25.9 S	.....	.....	....	35.12	G III
			Feb 11, 07	.....	.....	10.6, 12.0	29 22.8 S	.....	.....	....	169.12	G III
			Feb 11, 07	.....	.....	13.7	29 23.2 S	.....	.....	....	169.12	G III
			Feb 12, 07	11.4, 12.7	9 40.7 E	.....	.....	11.8, 12.4	.34060	1	.....	G III
Small Coral Island, 1*	17 32 S	210 25	Feb 6, 07	15.8	9 39.1 E	.....	.....	.....	.....	1	.....	G III
			Feb 7, 07	.....	.....	9.6	29 24.4 S	.....	.....	....	178.12	G III
Small Coral Island, 2*	17 32 S	210 25	Feb 6, 07	16.2	9 39.8 E	.....	.....	.....	.....	1	.....	G III
			Feb 7, 07	.....	.....	11.4	29 24.5 S	.....	.....	....	178.12	G III
			Feb 8, 07	.....	.....	10.8, 12.2	29 19.6 S	.....	.....	....	35.12	G III
			Feb 8, 07	.....	.....	14.2	29 28.0 S	.....	.....	....	169.12	G III
			Feb 9, 07	.....	.....	10.6, 13.8	29 29.8 S	.....	.....	....	35.12	G III
			Feb 9, 07	.....	.....	14.5	29 33.3 S	.....	.....	....	169.12	G III
			Feb 12, 07	14.8, 16.1	9 41.3 E	.....	.....	15.2, 15.8	.34008	1	.....	G III

TUAMOTU ISLANDS.

	° ′	° ′		h h h	° ′	h h	° ′	h h	Γ			
Motu Rao	15 13.1 S	212 21	Sep 8,'06	15.7	8 42.1 E	13.9	26 40.6 S	.....	.....	2025	171.(56)	GH
			Sep 9, 06	11.6, 16.3	8 37.4 E	9.5	26 39.4 S	14.7	.33580	2025	171.(56)	GH
			Sep 10, 06	.....	.....	.....	.....	14.6(wt.$\frac{1}{4}$)	*.3368*	*171*	.....	GH
			Sep 11, 06	14.0	8 41.2 E	.....	.....	9.8	.33592	2025	.....	GH
			Sep 11, 06	.....	.....	.....	.....	12.5(wt.$\frac{1}{4}$)	*.3366*	*171*	.....	GH
Rotoava	16 02.4 S	214 18	Sep 17, 06	15.5	8 55.3 E	14.3	28 01.6 S	16.4	.33815	2025	171.(56)	GH
			Sep 18, 06	12.5	8 49.2 E	9.4	28 01.5 S	11.3	.33809	2025	171.12	GH

* Local disturbance.

1. Station at Marten Creek, Quebec.

2. Station at Etah, Greenland.

3. Station at Rupert's House, Quebec.

4. Station at Sturgeon Tent, Saskatchewan, showing protection of Observers against Mosquitoes and Sand Flies.

5. Portage, Northern Quebec.

Typical Field Views by Observers in Canada and Greenland.

PROFESSORS J. C. BEATTIE AND J. T. MORRISON ON MAGNETIC WORK IN SOUTHERN AND CENTRAL AFRICA, 1908 TO 1909.

The Department of Terrestrial Magnetism was so fortunate as to have associated with it in the African work two experienced and enthusiastic investigators; Professor J. C. Beattie, of South African College, Cape Town, and Professor J. T. Morrison, of Victoria College, Stellenbosch, South Africa. Professor Beattie was connected with the Department as Research Associate, December 1, 1908, to January 31, 1910, and Professor Morrison as Magnetic Observer, for the year 1909. Both were granted the necessary furloughs by their respective institutions. A general account of their work, prepared by themselves, follows.

Professor Beattie's Account.

Magnetic observations in Southern and Central Africa, except at coast stations, have been carried out only in the last quarter of a century. Capello and Ivens were the first travelers who made it one of their objects to study the magnetic state of the country they explored. These two men started in Angola and traveled across the continent through what is now Portuguese West Africa and Northwestern Rhodesia to Tete on the Zambezi.[1] They determined the magnetic declination, the inclination, and the horizontal intensity at over 20 stations in the years 1884 and 1885.

The next series of magnetic observations was carried out in the Belgian Congo. In 1890 and 1891 Delporte and Gillis observed at 14 stations in the lower reaches of the river Congo; in 1898, 1899, and 1900 Lemaire observed at 120 stations in the upper reaches of the same river and its tributaries; finally, between 1902 and 1905, Lemaire observed at 35 other stations between the Congo River and Lado.[2] The methods employed and the instruments carried were the same in these three expeditions and the magnetic elements determined were the declination, the dip, and the horizontal intensity. Unfortunately only the declination results were satisfactory; the instruments used for the determination of the other two elements were unsuited for their purpose.

Between 1892 and 1906 a considerable amount of magnetic work was carried out in German East Africa, chiefly by Dr. Maurer.[3] Observations were made at 23 stations along the coast and for a time self-recording instruments were used at Dar-es-Salaam.

In Africa south of the Zambezi a magnetic survey was started in 1898 by Beattie and Morrison; between that date and 1906 observations were taken at more than 400 stations. The latitude and longitude were determined at each station and the three magnetic elements, the declination, the dip, and the horizontal intensity. A report[4] on this work has been published by the Royal Society, London; in it is included a summary of the previous work in South Africa proper.

Notwithstanding the considerable amount of work done, there was, and still is, a lack of magnetic data for great tracts of Africa. With the purpose of obtaining some information in these egions, the writer submitted in 1907 to the Carnegie Institution of Washington, through the Director of the Department of Terrestrial Magnetism, a scheme of further work in Africa. It was proposed to continue the line of magnetic stations from Victoria Falls to Gondokoro. North of that it was not deemed necessary to observe, as the Survey Department of the Egyptian Government had already put forward proposals for a magnetic survey of Egypt and the Sudan. It was

[1] Capello and Ivens. De Angola a Contra Costa. Lissabon, 1886.
[2] Keeling's Magnetic Observations in Egypt, etc. Cairo, 1907.
[3] Keeling. *L. c.*
[4] Report of magnetic survey of South Africa by J. C. Beattie, London, 1909.

planned also, should time permit, to make observations in German Southwest Africa. The original proposal was modified later, so as to include a second observer, with the idea of having two field parties. The Carnegie Institution of Washington, through its Department of Terrestrial Magnetism, provided a sum of $10,163 for the work and the expense in excess of this necessary for a second observer was defrayed by a grant of £250 from the London Royal Society and by Sir L. Starr Jameson and Sir Lewis Michell, who gave £100 for part of the work in Rhodesia; grateful acknowledgment is here made for these generous contributions toward the expense of the work.

The instruments used were the same as in the earlier work in South Africa and comprised the following: 5-inch theodolite and magnetometer No. 73, lent by the London Royal Society; dip circle No. 9 and magnetometer No. 31, belonging to the Royal Observatory of the Cape of Good Hope; a 6-inch theodolite, furnished by the South African College; two pocket chronometers, from the Department of Terrestrial Magnetism; and dip circle No. 142 and a box chronometer, contributed by the writer. Observations were made for determining the latitude, longitude, and the three magnetic elements: the declination, the dip, and the horizontal intensity; the methods employed were substantially the same as those described in the report on the previous work in South Africa and the degree of accuracy obtained of the same order as in the earlier observations.

The work was begun at the end of November, 1908, when Beattie started from Ceres Road in the Cape Province for Windhoek in German Southwest Africa. This journey[1] lasted four months. From Ceres Road to O'okiep the journey was made by ox wagon, through a region suffering at the time from drought. At O'okiep, where observations were taken by Beattie at the end of December, 1908, and beginning of January, 1909, and by Morrison in March, 1909, the magnetic elements had been previously determined in 1874 by Stone; in the course of this part of the journey a station which had previously been occupied by Beattie in January, 1907, was reoccupied in December, 1910. From O'okiep a short journey by mule wagon was made to Pella and then down the Orange River to Rahman's Drift and Henkriesfontein, and finally back to O'okiep; this part of the journey was through a region dry and sandy but healthy and invigorating despite the heat. On January 18 the journey was continued by mule wagon from O'okiep to Rahman's Drift; the Orange River—at the time in flood—was crossed there and the further journey made by ox wagon to Holoog, the then terminus of the railway from Luderitzbucht inland. From Holoog the journey was continued by rail to Keetmanshoop and Luderitzbucht. During this part of the journey the rain set in, entailing now and then loss of time by washaways in the line. The last part of the journey from Keetmanshoop to Windhoek was again by ox wagon; the rainy season had begun in earnest by this time, the grass began to spring up, bringing in its train numerous mosquitoes and making traveling difficult. Windhoek was reached at the end of March, when Beattie returned to Cape Town by sea.

Early in May the observers left Broken Hill, the then terminus of the Beira and Mashonaland railways, for Abercorn via Fort Rosebery. From Broken Hill the only means of transport was by porters; one set of instruments was carried from there more than 2,000 miles, the other over 1,400, the whole distance being accomplished without mishap to any of the instruments. In addition to the two observers the caravan consisted of about fifty natives; fortunately the time of year was very suitable for traveling, the rainy season was over, and there was no difficulty in obtaining food and water for the carriers; it was possible to march on the average about 15 to 18 miles per day. The march began at sunrise and continued usually until a little before noon; camp was then pitched and observations were made in the afternoon. The only inconvenience arose from tsetse flies, mosquitoes fortunately being absent; the altitude is sufficient in this region to give delightfully cool evenings. The journey took the observers through Northwestern Rhodesia, the Belgian Congo, and Northeastern Rhodesia to Abercorn, near the south end of Lake Tanganyika. The earlier part of the route intersected that of Capello and Ivens referred to earlier; in the latter part, the observations were made in a region to the south of the places occupied by Lemaire in his 1898–1900 survey.

At Abercorn the observers separated, Beattie continuing his journey into German East Africa. Some delay was occasioned by the lack of supplies at Abercorn, but in the end the

[1] For a fuller account of part of this journey see Pearson, "The Travels of a Botanist in Southwest Africa," *Geographical Journal*, p. 481, London, 1910.

Europeans there were good enough to give from their private resources in order that the journey might be continued. From Abercorn in Northeastern Rhodesia to Bismarckburg in German East Africa is a little over 30 miles, and it was here that the first serious difficulty arising from sleeping sickness was met. The authorities, English and German, had already recognized the seriousness of the situation created by the spread of this disease and great precautions were taken to restrain the natives from going in and out of sleeping sickness areas, a very difficult task. The inhabitants on the shores of Tanganyika had been removed about 15 miles from the lake and the port Kitutu was practically closed. Had it been open, matters would have been but little better, because the only steamer on the lake had been laid up as the two whites on it, the captain and the engineer, had contracted this sickness. The only means of getting from one place to another was to march overland, and then arose the difficulty of getting permission to hire carriers. However, in the end all difficulties were overcome and observations were made at Bismarckburg about the middle of July. Another caravan was got together at Bismarckburg to go as far as Tabora; the route was not well known but fortunately a few months before a non-commissioned officer had made the same journey and his notes were of the greatest help on the march. The caravan was now smaller than before; the times of marching and of working were the same as in Rhodesia; with only the one observer the day's work was somewhat more exacting. During the first few days of this part of the journey the country was much the same as in Rhodesia, wooded with poor timber about 30 feet high, with good water and food supplies, and belts of country infested with tsetse. After a march of a few days from Bismarckburg the country displayed another aspect: the woodland had disappeared and instead a series of grass-covered plains was crossed. The number and variety of game was very great; giraffe, zebra, eland and other big buck, and wild pig were seen almost daily and the camp at night was at times disturbed by leopards and lions. As the path led further north the temperature increased and from about the middle of July water was difficult to get and very unsatisfactory in quality. A rest of a few days was made at Tabora and, as the longitude of that place had been previously determined, the opportunity was taken to rate the box chronometer by sun observations. This was very necessary, as the comparisons for rating had been made only twice north of the Zambezi, once at Broken Hill and the other time at Abercorn. The telegraph stations at these places were put in direct communication with the Royal Observatory at the Cape and time signals transmitted from there.

At Tabora another caravan was made up and the journey continued to Bukoba on the western shore of Victoria Nyanza. In the first part of this journey the lack of good water became very troublesome; about September, however, the small rainy season set in and the water difficulty soon ceased; but other troubles began to show themselves. Soon after the rains had set in fever became rife among the carriers, two or three men had to be treated every evening for malaria; in addition the observer himself began to suffer from fever and was unable to throw it off during the rest of the journey. The conditions for working became much less satisfactory, sometimes for two or three days together no satisfactory sun observations could be made; the food supplies were bad, the tent and the bedding were almost constantly wet and the mosquitoes became very troublesome. Delays ensued through fever, dysentery, and bad weather; rests were longer and oftener.

At Bukoba it was found that no steamer was due for almost three weeks, so the journey was continued overland to Entebbe. The regulations for travelers passing from German East Africa to Uganda were such that carriers could only be taken from Bukoba to the border village Mtukula; there the caravan had to be dismissed and sent back to Bukoba and another set of carriers had to be hired from the nearest English station. The last caravan was made up at Entebbe; it had to be taken right through to Gondokoro, as great difficulty is experienced in hiring natives in the Nile valley for this kind of work. The prevalence of sleeping sickness made it necessary to go via Butiaba and there take ship to Koba. The journey from Entebbe to Butiaba was made in a rickshaw over a fairly good road; the weather, however, was not very suitable for observational work, the temperature was high and it rained often. From Koba to Gondokoro the journey was very trying; rain fell often at night, and the rivers running into the Nile were nearly all in flood; fever was prevalent and the temperature during the day and the night was much too high for comfort. Altogether, this part of the journey was very exhausting and it was with great relief that the observer was able to dismiss his caravan at Gondokoro and take ship for Khartoum.

Lemaire's observations on his second trip were made in this region and a party of observers from Egypt had observed previously at Bor, a station a little over 30 miles north of Lado. Beattie's field work accordingly ended at Gondokoro; he next compared his instruments at Helwan and Kew observatories.

PROFESSOR MORRISON'S ACCOUNT.

The program of work assigned to Professor Morrison, in the early months of 1909, was chiefly the making of observations at as many stations as possible along the two railway lines that start at Swakopmund in German Southwest Africa and run inland to Windhoek, the capital, and to Tsumeb, the headquarters of the Otavi Copper Mining Company, and also along the Port Nolloth-O'okiep Railway in the extreme northwest corner of Cape Colony (now the Cape Province of the Union of South Africa). He sailed from Cape Town for Swakopmund in the third week of January and returned from Port Nolloth in the middle of March, having made observations at 24 stations.

Owing largely to the generous assistance rendered by the German Government, the Otavi Copper Company, and the Cape Copper Company, as well as by their officials and private individuals, both parts of the work were executed under very favorable conditions. The German Government provided a free pass over the State Railway, the Cape Copper Company gave the same privilege over the Port Nolloth-O'okiep Railway, and the Otavi Copper Company allowed special facilities over the line under their control. Hearty thanks are tendered to all these authorities for their courteous help.

On the Swakopmund-Windhoek Railway the observing stations were from 20 to 30 kilometers apart; on the Otavi Railway, from 30 to 40 kilometers. In most instances, on both railways, there were few or no buildings near the railway station except those connected with the railway itself and it was considered sufficient to pitch the observing tent from 200 to 300 yards from the nearest house or shed, and at a not less distance from the railway. Similar remarks hold for the O'okiep Railway.

Of the routes traversed, the coastward portion for about 80 kilometers is almost rainless. Further inland, however, that is, in the case of German Southwest Africa, from Karibib and Usakos eastward, there is a fair rainfall during the months of January, February, and March, and in 1909 the rainfall was unusually great. It will be seen, however, from the records that fairly complete observations were made at almost all stations, and, in fact, the weather conditions were on the whole decidedly favorable. Towards the end of this part of the work, when a return was made to the dry region, difficulty was found in one or two cases with wind and dust. It was not found possible to adhere to a definite time of day for the various observations, as the observer's movements were largely governed by the railway time-table and other exigencies of travel not wholly within his control.

The second and chief part of the observing work undertaken by Professor Morrison was as follows:

1. Observations at Bulawayo, Southern Rhodesia, and along the railway line from Livingstone to Broken Hill, Northwest Rhodesia, during the last three weeks of April. Although the railway authorities of the Rhodesian railways did everything in their power to facilitate the observer's work, and in addition to a free pass over their system, provided a special van which was detrained as required, fewer observing stations were occupied than had been hoped. This was due partly to the infrequency of the railway service and partly to serious flooding at the Kafue River. The method of work was similar to that described as followed in German Southwest Africa.

2. Observations made in conjunction with Dr. Beattie between the beginning of May and the beginning of July on the line of march extending for about 600 miles from Broken Hill, Northwest Rhodesia, to the west of Lake Bangweulu via Fort Rosebery and Luwingu to Abercorn, Northeast Rhodesia, at the southern end of Lake Tanganyika.

3. From July 9 till the end of the third week of September, observations were made along a route that ran southeast from Abercorn through Nyassaland as far as Port Herald, a distance of about 850 miles, and thence along the Shire and Zambezi Rivers to a point about 50 miles inland from Chinde. The march, like the preceding, was on foot as far as Port Herald. It first proceeded along the so-called Stevenson road from Abercorn in Northeast Rhodesia to Karonga on the northwest shore of Lake Nyassa, about 230 miles. It then skirted the western shore of the

lake southward for about 50 miles to Florence Bay, and suddenly once more ascended to the plateau of Nyassaland at the famous mission-station of Kondowe (Livingstonia). Thence it followed the district main road southward along the Rukuru, through Mzimba, Loudon, Kasungu, Ngara, Kongwe, Dowa, Lilongwe, Mpunzi, Mlanda, Dedza, Ncheu, Matope, Blantyre, Cholo, Chiromo, Port Herald. At Port Herald a small river house-boat was secured, by means of which observations were continued along the Shire and Zambezi Rivers till it had to be abandoned to insure being in time for the ocean steamer at Chinde.

From Abercorn onwards the daily routine was as follows. Camp was broken shortly before 6 a.m., and a march of about 10 miles made till about $8^h\,40^m$ a.m. While the tent was being erected and breakfast prepared, forenoon observations of the sun were taken. These were followed by observations of declination, horizontal intensity, latitude, and dip. The set was usually completed between 2 and 3 p.m.; after some additional refreshment marching was resumed, and continued usually till about $5^h\,30^m$ p.m. In this way an average march on week days of about 19 miles per day was easily maintained. On Sundays a short march was made in the morning, and the remainder of the day was devoted to rest and correspondence.

The weather was, throughout, almost ideal for observing purposes. But for two negligible showers, no rain fell between the first week of May and the first week of September, and on the plateau which was traversed by much the greater part of the march, the air was cool, clear, and bracing. At this season the climate appears particularly healthy. About four working days were lost through mild attacks of "fever," doubtless contracted in April during the work on the Rhodesian railways. Good marching roads or paths from 8 to 12 feet wide were available from Abercorn onwards. Some of these were excellently made, and all appeared kept in wonderfully good order. Acknowledgment must be made of the almost overwhelming hospitality experienced all along the route, at the hands both of the magistrates and officials of the British South African Company and of Nyassaland and of the missionaries of the London Missionary Society, United Free Church of Scotland, Dutch Reformed Church of South Africa, and the Established Church of Scotland. It is also only right to say that much of the comfort with which the work was done was due to the faithfulness of the native helpers.

4. From Chinde, Professor Morrison proceeded to Dar-es-Salaam via Mozambique and Zanzibar, at which places an attempt was made to make observations during the stay of the steamer. From Dar-es-Salaam observations were made, for a distance of about 230 kilometers, along the line of the Dar-es-Salaam and Morogoro Railway, in the same way as has been already detailed for the German Southwest African Railway. As before, much courtesy was shown by the German Government and its officials, as well as by private individuals. Special mention must be made of the kind assistance extended by the Government meteorologist, Dr. Kastens.

5. In British East Africa observations were made along the Uganda or British East African Railway, which runs from Mombasa northwest to Port Florence on Lake Uganda, a distance of 564 miles. Everything was done by the Government and railway authorities to further the work. The observer was relieved at Mombasa of the cares of the landing and transport of baggage and instruments. A comfortable sleeping and kitchen car was set aside for his use free of charge during the whole six weeks of his stay, and moved from station to station as required. The result was that more work was done in the time available than could have been achieved under any other circumstances; warm acknowledgment is therefore due for the assistance thus given. The weather conditions were on the whole favorable, but work was stopped at a few points by heavy rain. Much of the inland part of the country from Nairobi westward appeared to show evidences of igneous and volcanic action. Observations were taken at from 25 to 30 miles apart and the conditions as to paucity of houses at most observing points were much as in German Southwest Africa.

DISTRIBUTION OF STATIONS.

The distribution of stations occupied by the two observers between October, 1908, and January, 1910, was as follows: Jointly, 6 in the Belgian Congo, 1 in the Cape Province, 1 in Egypt, 1 in England, and 39 in Rhodesia—in all 48; by Beattie, 36 in Cape Colony, 45 in German Southwest Africa, 60 in German East Africa, 3 in Rhodesia, and 33 in the Uganda Protectorate—in all 177; by Morrison, 35 in British Central Africa, 28 in British East Africa, 4 in Cape Colony, 10 in German East Africa, 24 in German Southwest Africa, 6 in Portuguese East Africa, 15 in Rhodesia

and 1 in Zanzibar—in all 123. The total number of stations was 348, a number rendered possible by the plan adopted of taking observations at each camping-place. In addition to the results obtained on this expedition, the observations at 15 stations occupied during June and July, 1908, in the Cape Province, Natal, and the Transvaal have been embodied as well as other observations at 18 stations in the Cape Province in January and February, 1907.

Much of the information was obtained in various parts of Africa for the first time and also valuable results have been secured for the secular variation of the elements in many regions, more particularly in Africa south of the Zambezi and along the east coast of the continent. The large annual change in the latter region is particularly interesting.

While making the preliminary arrangements for the journey, the observers received great assistance from the then Governor of the Colony of the Cape of Good Hope, Sir Walter Hely Hutchinson, who communicated with the authorities of the territories it was proposed to survey and obtained permission for the observers to enter them and to enjoy special privileges while there.

In German Southwest Africa the authorities allowed the observers to travel free of charge over the Government railways; the same privilege was extended by the Cape, the Central South African, and the Uganda railways; concessions were also granted on the Sudan and on the Egyptian Government steamers and railways, and great help was received from various members of the staff at Helwan and at Kew. In addition the courtesy and hospitality of the English and the German officials did much to relieve the tedium and strain incident to work of this nature.

The reduction of the results has been carried out at Washington under the Director of the Department of Terrestrial Magnetism by Messrs. J. A. Fleming and H. W. Fisk.

EXTRACTS FROM FIELD REPORTS.

The following extracts from the observers' field reports will give some idea of the conditions under which the work was done and will help in showing the scope and varied operations of the Department of Terrestrial Magnetism.

J. A. Fleming, on Magnetic Work in Central America, March to June, 1907.

In accordance with instructions, the work was begun at Belize, Honduras, on March 4, 1907, the instrumental outfit being the same as used by Observer Ault in Mexico during December, 1906, to February, 1907. The stations occupied were as follows:

1. Belize, British Honduras.
2. Punta Gorda, British Honduras.
3. New Haven, British Honduras.
4. Puerto Cortez, Honduras.
5. La Ceiba, Honduras.
6. Zacapa, Guatemala.
7. Guatemala City, Guatemala.
8. Salama, Guatemala.
9. Tactic, Guatemala.
10. Coban, Guatemala.
11. Cabulco, Guatemala.
12. Chiche, Guatemala.
13. Huehuetenango, Guatemala.
14. San Marcos, Guatemala.
15. San Felipe, Guatemala.
16. Champerico (Chapan), Guatemala.
17. San José, Guatemala.
18. Flamenco Island, Panama.
19. Colon Harbor, Panama.
20. Bocas del Toro, Panama.
21. Uvita Island, Costa Rica.
22. San José, Costa Rica.
23. Sarchi, Costa Rica.
24. Koschny (San Carlos), Costa Rica.
25. Puntarenas, Costa Rica.
26. Ballena, Costa Rica.
27. Punta Dominical, Costa Rica.
28. Golfo Dulce, Costa Rica.
29. David, Panama.
30. Barranca Colorado, Panama.
31. Cristobal, Canal Zone.

Of these, station No. 1 is practically a reoccupation of that of 1879, station No. 18 of that of 1866 and No. 31 of that of 1905. Station No. 16 is about 0.8 mile northwest of the station of 1880.

Unfortunately the progress of the work was greatly retarded by the war at the time between the Republics of Nicaragua and Honduras. While this disturbance was nominally confined to the two countries mentioned, it involved also Salvador and produced much unrest even in Guatemala. The work in Guatemala was executed without delay other than that caused by extremely poor traveling conditions; many of the stations could only be reached by poor and indifferent mountain roads and trails on which, with pack mules, not more than 30 miles could be made in a 12-hour day while the trails were too poorly marked to attempt travel by night. Owing to the conditions in Salvador and Nicaragua, resulting from the war, I proceeded from San José, Guatemala, directly to Ancon, Canal Zone. As an example of the traveling conditions at the time in Central America, it may be noted that this connection was made only after a week's wait after scheduled time of steamer, and on the first steamer in six weeks. From Panama, I crossed the Isthmus to Colon and went thence along the Atlantic Coast to Costa Rica, where the advance of the rainy season was already putting the roads in bad condition. Crossing to the Pacific Coast, the trip was continued, by a small sail-boat, from Puntarenas along the coast of Costa Rica into Panama at David, whence a bi-weekly steamer service enabled me to complete the Panama work via Panama City and Colon. I returned to Washington from Colon via New York, on June 28.

The occupation of the 31 stations listed above consumed, inclusive of all travel, 125 days, or at the rate of one station every 4 days. The time consumed in travel to and from the field and the delays experienced in the field by reason of accident to gasoline launch at Belize, at Bocas del Toro, and irregular steamship connections easily amounted to 1½ days per station. Of the 31 stations, 11 could be reached only by mule travel, 10 by small ocean sailing-boats, and but 10 by railroad or steamship.

The preliminary reductions made in the field indicated that the magnetic conditions are more or less disturbed for much of the area covered. Information regarding other disturbed areas in the interior of Honduras and of Nicaragua was received from several engineers.

The experience gained has shown the desirability of light instrumental outfits. It is not always possible to secure good pack mules, and the heavier the outfit the slower the progress which can be made with these animals. It will frequently happen that men packers are more suitable, in which case heavy outfits are a great hindrance. For work in the interior, it is preferable to carry camping outfits. A hammock was found to be the most convenient bed, particularly as it did not weigh more than 5 or 6 pounds; blankets are necessary in the mountains. Knee-lace boots are a necessity for both riding and tramping. A speaking knowledge of Spanish is decidedly desirable, as few English-speaking people are met with in the interior. Work should be attempted, as far as possible, only during the so-called dry season, from about December to early May.

Throughout the trip every possible courtesy was shown me. Señor Barrios, minister of foreign affairs of Guatemala, kindly supplied me, through our minister to Guatemala, with a letter of introduction to various government officials. In British Honduras, the colonial officials were extremely kind. I am particularly under obligation to Dr. H. Clement, resident commissioner at Punta Gorda, who rendered substantial assistance, as also to others who showed their interest in various ways.

H. W. FISK, ON MAGNETIC WORK IN THE BERMUDA ISLANDS, JULY AND AUGUST, 1907.

According to instructions, I left Washington, July 2, bound for Bermuda, in company with the Harvard University biological party in charge of Professor E. L. Mark. My outfit consisted of magnetometer No. 3, dip circle No. 172, pocket chronometer Kittel No. 254, Hamilton watch No. 56, observing tent No. 9, camera No. VII, and miscellaneous appurtenances.

At Bermuda, it was my good fortune, through the kindness of Professor Mark, to have quarters with the biological party at Agar's Island, and we are indebted to him for other courtesies.

Five primary stations were established, the base station at Agar's Island (occupied three times), Ireland Island, Spectacle Island (near Gibbs' Hill), St. George, and Nonsuch Island. None of the *Challenger* stations could be positively identified except the one near the "Dockyard" and that unfortunately was no longer available, owing to possible disturbing influence from the great steel floating dock about 400 feet away. The *Challenger* stations at Cricket Ground (Somerset), Tatem's Point, Spanish Point, Cobbler's Island, Clarence Cove, Spectacle Island (primary), Hawkins Island, Wreck Hill, Ducking Stool, Mount Langton (pedestal), in the absence of detailed information, could be only approximately occupied. About 77 secondary stations were established, which with the primary ones make a total of over 80 stations. At about 45, all three elements were observed more or less completely; at the remainder, deflections only were obtained. It did not seem advisable to make any serious attempt at running out ranges, as the country was thickly wooded and densely populated. The roads were very crooked, thus preventing the obtaining of long ranges on them; only along exposed coast lines were extended ranges possible. Diurnal variation observations were made, covering three entire days and a morning and evening of two others.

There are numerous caves of considerable size in the group; in some of these, magnetic observations could be made with more than 100 feet of rock and earth above, affording opportunity for further investigations on local disturbances. The openings in some of the caves permit of running azimuth lines directly into them by means of the theodolite. Observations could therefore be made on and below the surface in the same vertical line There are also some shoal places where, in quiet weather, a tripod could be placed in shallow water and observations made at some distance from the mainland. This was done at North Rock, 10 miles from land on the north edge of the plateau.

H. W. FISK, ON MAGNETIC WORK IN THE WEST INDIES AND THE GUIANAS DURING JULY TO DECEMBER, 1908.

The work was in pursuance of instructions of July 7, 1908, and of October 23, 1908. The instrumental outfit consisted of magnetometer No. 4, using the short deflection bar, and Lloyd-Creak dip circle No. 189 supplied with four needles, tripod, tent, and other accessories. The expedition started from New York on July 11, 1908, sailing on the steamer *Orinoco* of the Royal Mail Steam Packet Line, for Bridgetown, Barbados. Kingston was reached on evening of July 16; as the steamer sailed at 10 o'clock the next morning, only a few hours were available for observing.

However, with the assistance of Mr. Kidson, some magnetic observations were obtained at the station established at this port by Mr. Ault in 1905. As the mark used by him at Port Royal was located within the area chiefly affected by the earthquake subsequent to his visit, it was necessary to check the azimuth of the mark; it was found, however, that no sensible change had occurred. At Colon, Mr. Fleming's station of 1907 was reoccupied.

In Colombia, observations were made at Cartagena and Savanilla. At the former port, the time available was very brief and at the latter, delay was experienced in gaining permission to carry the instruments ashore; the observations at these stations were therefore not as complete as desirable. Owing to the political conditions in Venezuela, the steamer was not allowed to to make calls at any ports in that country; hence the observations as planned in Venezuela had to be omitted.

On the island of Barbados, two stations were established. The first was at Bridgetown; owing to the erection of a large stone building near the point at which Mr. D. C. Sowers had determined the magnetic elements in 1905, it was necessary to make the 1908 observations at another point located in the open ground not far from the 1905 station. Test observations made at secondary points northward and westward of the 1908 station did not show any marked local disturbance. The next station was at Bathsheba, at a point on the opposite side of the island, selected especially to determine whether the values at Bridgetown were altered by the high ridge of volcanic character extending north and south, along the length of the island.

On August 4, I sailed for Georgetown, British Guiana, arriving there August 6. The plan followed in the selection of stations in the Guianas was determined by the geographical distribution of rivers, which are the main routes of travel. These form a series of broad streams running northward, practically parallel to each other, opening channels which are navigable various distances, from 50 to 150 miles inland. In British Guiana, the Sprostons Company, Limited, under contract with the colony, operates a system of transportation over most of the navigable waters of the region, so that it was possible to make short trips starting from Georgetown. Accordingly, after having established a base station at Georgetown, a number of expeditions were made to available points, and magnetic observations were then secured at stations given in the list below. The first expedition was from Georgetown about 200 miles to Morowhana, near the mouth of the Barima River; this point is the approximate location of Schomburgk's magnetic station of 1847. Thence a trip was made inland about 100 miles to Arakaka and Barima Mine; observations were obtained at Mount Everard on the return to Morowhana. The second expedition from Georgetown was a short trip of about 40 miles northwest to Suddie, a point on the coast. The third was up the Essequibo River, about 60 miles from Georgetown to Bartica, at the junction of that river with the Cuyuni. With the aid of transportation facilities furnished by a local rubber company, a trip was made, early in September, to Kaieteur Falls on the Potaro River, approximately 150 miles inland, and magnetic observations were thus secured at several stations along the way. The station at Malali, at the head of navigation on the Demarara, was reached from Wismar on the return from this trip. The next stations were those at New Amsterdam and at Springlands. The writer was prevented by an attack of fever from occupying a station up the Berbice River starting from New Amsterdam; however, an expedition from Springlands, up the Corentyne River, to Oreala was carried out later.

The number of accessible regions in Dutch Guiana, on account of the nature of the streams and the absence of other routes of travel, is small. A short railway extends inland about 100 kilometers to Brownsweg where observations were made, but the other points reached had to be comparatively near the coast.

In French Guiana even less opportunity than in British and in Dutch Guiana was found for obtaining well-distributed observations; however, with the aid mentioned below, 3 stations were occupied, including one at Cayenne, and also one at the penal colony on Île Royale where observations had been made by Harkness in 1865. Returning to Georgetown, observations at additional points in British Guiana and in Dutch Guiana were secured. On the voyage homeward, a brief stop at Port of Spain, Trinidad, made possible a few observations at the station of 1905 established by Observer Sowers.

The months of September, October, and November, as they constitute the dry season, are favorable to observational work along the low coast countries; but as the rivers are then at a low stage it is not so easy to get to interior points, and the danger of contracting fever and other tropical disorders is much increased.

The whole work may be summarized as follows: More or less complete magnetic observations, according to the conditions encountered, were made at each of the following points:

1. Kingston, Jamaica.
2. Colon, Panama.
3. Cartagena, Colombia.
4. Savanilla, Colombia.
5. Bridgetown, Barbados.
6. Bathsheba, Barbados.
7. Georgetown, British Guiana.
8. Arakaka, British Guiana.
9. Barima Mine, British Guiana.
10. Mount Everard, British Guiana.
11. Morowhana, British Guiana.
12. Suddie, British Guiana.
13. Bartica, British Guiana.
14. Tumatumari, British Guiana.
15. Potaro Mission, British Guiana.
16. Kangaruma, British Guiana.
17. Tukeit, British Guiana.
18. Kaieteur Falls, British Guiana.
19. Rockstone, British Guiana.
20. Wismar, British Guiana.
21. Malali, British Guiana.
22. New Amsterdam, British Guiana.
23. Springlands, British Guiana.
24. Paramaribo, Dutch Guiana.
25. Onverwacht, Dutch Guiana.
26. Albina, Dutch Guiana.
27. Cayenne, French Guiana.
28. Regina, French Guiana.
29. Île Royale, French Guiana.
30. St. Jean, French Guiana.
31. Sault Hermina, French Guiana.
32. Brownsweg, Dutch Guiana.
33. Gronigen, Dutch Guiana.
34. Nieuw Klarenbeek, Dutch Guiana.
35. Frankville, British Guiana.
36. Oreala, British Guiana.
37. Georgetown, British Guiana, reoccupation.
38. Port of Spain, Trinidad.

Of these, Nos. 1, 5, and 38 are C.I.W. repeat stations; Nos. 11 and 29 are practical reoccupations of stations established by earlier observers. Little evidence of local disturbance was found in the localities near the coast, this region being formed by sedimentary deposits of the large rivers, Orinoco and Amazon, as well as of the smaller rivers traversing the region. Inland, along the ridges, outcroppings of rock seem to be magnetic in some places. The station at Sault Hermina showed local disturbance.

The natural difficulties of travel encountered in the execution of the work were largely overcome by reason of the cordial and effective cooperation received from the official representatives of the countries traversed and from various private citizens. These acts of assistance were so numerous that only a general acknowledgment can be made here.

J. C. PEARSON, ON MAGNETIC WORK IN WESTERN CANADA, AUGUST TO OCTOBER, 1907.

In pursuance of instructions, I left the magnetic survey vessel *Galilee* at Sitka, Alaska, in August, 1907, to establish magnetic stations in the Yukon Territory, Canada, and to reoccupy as nearly as possible Ogilvie's stations of 1887. This portion of the work was completed about the middle of September, after which the trip was continued to Vancouver, British Columbia, where instructions for additional work in Canada were received; the work was finally completed on October 16.

The instrumental outfit consisted of theodolite-magnetometer No. 1, dip circle No. 35, pocket chronometer Kittel No. 253, Hamilton watch No. 54, magnetic observing tent No. 10, and miscellaneous appurtenances.

The following stations were occupied in the order given:

1. Whitehorse, Yukon Territory.
2. Dawson, Yukon Territory.
3. Forty Mile, Yukon Territory.
4. International Boundary, Yukon Territory, comprising—
   a. C. I. W. Station on newly determined boundary line,
   b. Ogilvie's "International Boundary," 2 miles east of boundary.
5. Stewart, Yukon Territory.
6. Fort Selkirk, Yukon Territory.
7. Tantalus, Yukon Territory.
8. Ashcroft, British Columbia.
9. Glacier, British Columbia.
10. Norway House ,N. W. T., comprising—
    Station *A*, the principal and permanently marked station,
    Station *B*, secondary station for testing local disturbances,
    Station *C*, secondary station for testing local disturbances.
11. Warren's Landing, Northwest Territories.
12. West Selkirk, Manitoba.

Of these stations in the Yukon district, all except Whitehorse and Dawson were in the vicinity of Ogilvie's points of observation. No information, however, could be obtained from the inhabitants concerning any of Ogilvie's stations, nor could any marks or other evidences of his magnetic work be found.

At Dawson, in addition to the usual magnetic observations, sets of azimuth and observations for *diurnal change in declination* were made on two days. Two other stations were desired, but not obtained, on this portion of the trip: at Bennett, British Columbia (new), and at Port Simpson, British Columbia (repeat). These were of less importance and were omitted because of the lateness of the season.

At Warren's Landing and Norway House, near the north end of Lake Winnipeg, magnetic observations had formerly been made by Lieutenant Lefroy (1843–44) and by Dr. Klotz (1884). Although supplied with memoranda relating to the work of these observers, I was unable to discover the exact location of their stations and could not find any one who remembered them. In anticipation of this lack of information, it was planned to occupy secondary stations in the vicinity of the main stations established at these points. This program was fully carried out at Norway House, but time was not available for secondary observations at Warren's Landing.

Local disturbances may well be suspected at a number of points. All stations on the Yukon and in British Columbia are surrounded by mountains of volcanic origin and large deposits of iron are known to exist in the region about Lake Winnipeg. Secondary stations were established at Ashcroft, British Columbia, and Norway House, Northwest Territories, but the results showed no large deviations from the primary stations. The two stations near the boundary between between Alaska and Canada (about 2 miles apart) likewise failed to indicate any strong local influence. Stormy weather prevented making secondary observations at Dawson as planned.

Certain local disturbances of large amount were reported to me by the captains of steamers on the Alaskan Coast and on Lake Winnipeg. On entering the harbor at Fort Seward near Haines' Mission, Alaska, the compass was observed to swing five-eighths of a point while the ship was held on a steady course. The captain reported that the deviation was less on the way out of the harbor, the course being farther to the north. On Lake Winnipeg, Captain Thorburn, of the *Premier*, reported a deviation of one and one-half points of the compass off Rabbit Point in latitude 51° 50′, and a somewhat smaller deviation north of Grindstone Point off Berry Island in latitude about 51° 26′.

Inquiries were made, as instructed, concerning the frequency and brilliancy of *auroral lights* in the Yukon region, many persons of various degrees of intelligence being asked for information on the subject. Practically all were agreed that the displays become more brilliant as one goes farther north. By far the greater number of people testified that they had heard the northern lights; but a few whose powers of observation seemed to be better trained, and, in general, the more intelligent class, denied that any sounds could be heard. With regard to *auroras actually observed* on the trip, there may be mentioned one very fine display on the evening of September 15, between 10 and 11 o'clock, when I was *en route* up the Yukon in the vicinity of Hootalinqua. Also on the evenings of October 14 and 15, the aurora was almost continuously visible, but not remarkably brilliant; this was on the lower end of Lake Winnipeg and at Selkirk, Manitoba.

Travel from Skagway to Dawson was via the White Pass and Yukon Route, by rail to Whitehorse and thereafter by steamboat. In view of the uncertain transportation facilities below Dawson, passage was taken down river on the coal tug *Lightning*, plying between Dawson and the Sourdough Coal Mine, 6 miles below Forty Mile. The trip from Forty Mile to the International Boundary was accomplished in a Petersborough canoe, a guide being employed 6 days for this purpose. So swift was the river below Forty Mile that only 6 hours were required to cover the distance of 40 miles down stream, while 2½ days of the most fatiguing toil were spent in making the same distance up stream: 4 of the 6 days were rainy. On the way up river, stops were made at Stewart, Fort Selkirk, and Tantalus; some time was lost by the uncertain schedule of the river boats.

From Skagway, the journey was continued on the *Princess Royal* to Vancouver, British Columbia. The stations at Ashcroft and Glacier, British Columbia, were established *en route* from Vancouver to Winnipeg and Selkirk, Manitoba, via the Canadian Pacific Railroad. Transportation from Selkirk to the north end of Lake Winnipeg was furnished by the Dominion Fish Company of Selkirk, on the steamer *Premier*. Passengers and freight for Norway House were transferred at Warren's Landing to the small steamer *Keewatin*, owned by the Hudson's Bay Company. It is of interest to note that this remarkable vessel made the down-stream journey of 20 miles in 7 hours, and return journey in 12 hours. On reaching Selkirk, work was closed and return made to Washington, via St. Paul and Chicago.

In conclusion, acknowledgment should be made of the assistance received from various persons, among whom may be specially mentioned: Mr. H. G. Dickson, Dominion land surveyor, of Whitehorse, Yukon Territory; Mr. C. W. Theband, of Denver, Colorado; Mr. Ross Moulton, customs-inspector at Forty Mile, Yukon Territory; Rev. George Pringle, of Dawson; Mr. Arthur Symonds, of the Royal Northwest Mounted Police; Mr. McLachlin, telegraph operator at Fort Selkirk; Mr. C. C. Chipman, commissioner of the Hudson's Bay Company at Winnipeg; Mr. Donald McTavish, chief factor of Norway House; Bursar Stewart, of the Manitoba Insane Asylum at West Selkirk.

J. P. AULT, ON MAGNETIC WORK IN NORTHERN CANADA, JUNE TO SEPTEMBER, 1908.

Acting in accordance with instructions of June 2, 1908, I left Washington June 5 for Winnipeg, Canada, accompanied by Observer C. C. Stewart as assistant, in order to establish a series of magnetic stations in Northern Canada. The following instrumental outfit was assigned to the party: magnetometer No. 7, dip circle No. 172 with dip needles 1 and 2, and intensity pair 3 and 4, pocket chronometers Kittel Nos. 256 and 257, and observing tent No. 7.

Upon arrival at Winnipeg, June 8, Mr. C. C. Chipman, commissioner of the Hudson's Bay Company, was consulted regarding the best route for a trip into the north of Canada and as to the necessary arrangements. The station at Winnipeg was reoccupied on June 9 and 10, the party leaving Winnipeg the evening of the 10th for Prince Albert. Here final arrangements were made and the required outfit was secured for a canoe trip into the northern provinces, the route followed being by way of Cumberland House, Sturgeon Lake, Frog Portage, Churchill River, and north to latitude 60°. The return was made over the same route as far as Cumberland House and thence down the Cumberland River to The Pas and from there to the Canadian Northern Railway at Hudson's Bay Junction, over the recently completed section of the new railway to Fort Churchill.

The trip to Cumberland House was made on board the Hudson's Bay Company's steamer *Saskatchewan* and occupied 2 days, the start being made from Prince Albert on June 13. At Cumberland House two guides were secured and after a delay of 6 days, on account of adverse weather conditions, our canoe trip was begun on June 22; this trip consumed 68 days, the northernmost point, Canoe Limit, being reached on August 2. The return to The Pas was accomplished by August 29. Prince Albert was reached on September 8, and from there I returned to Washington, D. C., on September 18, leaving Mr. Stewart to carry out further work on the railways of Canada (see Mr. Stewart's report).

The total time required for the work was from June 5 to September 18, or 105 days, giving an average total time of 5.5 days per station; the time spent in traveling to and from the field was 12 days. The total travel approximated 5,800 miles; the field travel was 1,800 miles, 1,600 of which were by canoe, giving an average of 95 miles field travel per station. During the 1,600 miles by canoe, 71 portages were made varying in length from 100 yards to 2 miles. It rained on 36 of the 68 days spent in canoe travel, but most of the rains were of short duration and caused little delay. We were delayed 6 days at Cumberland House before starting the canoe trip, and 5 days at The Pas on account of the weather and the necessity of waiting for a hand-car.

During the expedition the following stations were occupied:

No.	Date	Name	Remarks
1	June 9, 10	Winnipeg	C. I. W. repeat station
2	June 15 to 20, Aug. 25, 26	Cumberland House	
3	June 24	Sturgeon's Tent	
4	June 26, 27	Scoop'em Rapids	
5	June 29	Pelican Narrows	
6	July 1	Frog Portage	Near Lefroy's station
7	July 3, 5	Two Rivers	
8	July 6, 7, Aug. 17, 18	Deer's Lake	
9	July 9, 10	Spruce Rock	
10	July 11, 12	Antoine's Bay	
11	July 14, 18, Aug. 12	Lac du Brochet	
12	July 23, 24	Jack Fish Lake	
13	July 28, 29, Aug. 7	Husky Post	
14	July 31, Aug. 1	Husky Portage	
15	Aug. 3, 4	Canoe Limit	
16	Aug. 29, Sept. 2	The Pas (Lefroy's Sta.)	Near Lefroy's station
17	Sept. 1	The Pas (C. I. W. Sta.)	
18	Sept. 7	Hudson's Bay Junction	
19	Sept. 9	Prince Albert	Jackson's station of 1907

A violent magnetic storm occurred on July 15, during diurnal-variation observations at Lac du Brochet; another one was noted at Pelican Narrows on August 21. A small display of the northern lights was witnessed at Pelican Narrows on August 20, and on August 21 occurred a most brilliant display, declared to be the finest ever seen by the older inhabitants of the place. It manifested itself in long streamers shooting rapidly downward and in undulating curtain effects with form and position ever changing.

Acknowledgment should be made of the kindness and courtesy of Mr. C. C. Chipman, commissioner of the Hudson's Bay Company, in furnishing information, assistance, and credentials to the party, as also of the valuable aid rendered by Mr. H. B. Hall, in charge of the Saskatchewan district.

C. C. STEWART, ON MAGNETIC WORK IN WESTERN CANADA, SEPTEMBER TO NOVEMBER, 1908.

Upon returning from the expedition to the Canadian North (see Mr. Ault's report, above), the magnetic elements were determined by me, in accordance with supplementary instructions, at the stations enumerated below, using the following outfit: theodolite magnetometer No. 7, dip circle No. 172, pocket chronometer Kittel No. 256, Hamilton watch No. 2, magnetic observing tent No. 7, and miscellaneous appurtenances.

While traveling, the dip circle and the magnetometer were always taken with me on the train, whereas the tent (in which were packed the two tripods and deflection bar) and all personal baggage were checked as baggage.

Leaving Prince Albert, Saskatchewan, on September 10, the following magnetic stations were established:

1. Saskatoon, Saskatchewan.
2. Melfort, Saskatchewan.
3. Swan River, Manitoba.
4. Dauphin, Manitoba.
5. Kamsack, Saskatchewan.
6. Quill Lake, Saskatchewan.
7. Gladstone, Manitoba.
8. Oak Point, Manitoba.
9. Battleford, Saskatchewan.
10. Lloydminster, Alberta.
11. Edmonton, Alberta.
12. Lacombe, Alberta.
13. Calgary, Alberta.
14. Macleod, Alberta.

Of these, Nos. 9, 11, and 13 were repeat stations, having been occupied by the Canadian observer, Mr. W. E. W. Jackson, in 1907. Several days of rain and snow about the last of September, as well as a week of rain during the latter part of October, delayed the progress of the work.

The trip was next continued to Mattawa, Ontario, where the Canadian station of 1907 was reoccupied. While *en route* to Washington instruction in observing was given to Mr. W. H. Sligh; observations were made by him under my direction at Havre de Grace, Maryland, near the 1899 station of the Coast and Geodetic Survey, and on an island in the Susquehanna River, near the same town. The 1897 magnetic station of the Maryland Geological Survey at Chestertown was reoccupied, and a new station was established at Bowie, Maryland.

All computations were made in the field and so far as was expedient were finished before leaving a station; no pronounced local disturbances were noted. The officials of the Hudson's Bay Company and of the Royal Northwest Mounted Police were very courteous in allowing stations to be located on their reserves and in helping to relocate old stations which had been previously established.

C. C. STEWART, ON A MAGNETIC EXPLORATION TRIP TO JAMES BAY IN 1909.

Acting according to instructions of June 10 and June 23, 1909, I left Washington on the evening of June 23 for North Bay, Ontario, Canada, with the following instrumental outfit: theodolite magnetometer No. 11, dip circle No. 202, pocket chronometer Kittel No. 258, Hamilton watch No. 53, magnetic observing tent No. 12, and miscellaneous accessories.

From the date of arrival in North Bay till July 10, the time was spent in the preparations for the part of the season's work which lay beyond civilization and in occupying the following stations:

1. Mattawa, Ontario, repeat station, exact location,
2. New Liskeard, Ontario, repeat station, new location,
3. Englehart, Ontario, repeat station, new location,
4. Matheson, Ontario, new station,
5. North Bay, Ontario, repeat station, approximate location.

The additional articles required, almost without exception, were purchased through the Hudson's Bay Company at North Bay and sent directly to Matheson; two Indians were also engaged through the company for the entire trip.

All preliminaries having been finally arranged, we left Matheson by canoe early in the afternoon of July 10, and from then till October 16 the following route was covered: to Abitibi by way of the Black and Abitibi rivers and the Abitibi Lake; to Moose Factory by way of the Abitibi Lake and River and the Moose River, a stop being made at Abitibi Crossing in order to send observation-records from Cochrane to the office at Washington; to Rupert's House by a York boat across James Bay, it being inadvisable to make the trip by canoe on account of probable rough water and because of the great mud flats during low tide; the Rupert River by way of Nemaska to the Marten River; by Marten River and various lakes and again by the Rupert River to Lake Mistassini and the Hudson's Bay Company's post called Misstassinny, this route being locally known as the "Lakes Route" from Nemaska to Misstassinny; thence to Lac St. Jean by various lakes and rivers, the route being again locally known as the "Lakes Route." On reaching Pointe Bleue on October 16, I immediately closed my business with the Hudson's Bay Company, sent my two Indians back to their homes and returned to Washington October 28.

During the trip the following stations were occupied:

4. Matheson, Ontario, secondary station to that formerly occupied.
6. Twin Falls, Ontario, new station.
7. The Narrows, Ontario, new station.
8. Abitibi Lake, Hudson's Bay Company Post, Quebec, new station.
9. Abitibi Crossing, Hudson's Bay Company Post, Ontario, new station.
10. Singed Marten Creek, Ontario, new station.
11. Little Lakes Portage, Ontario, new station.
12. New Post, Hudson's Bay Company Post, Ontario, new station.
13. Island Rapids, Ontario, new station.
14. Red Rock, Ontario, new station.
15. Moose Factory, Hudson's Bay Company Post, Ontario, repeat, new location.
16. Rupert's House, Hudson's Bay Company Post, Quebec, repeat, new location.
17. Ka-ba-she Bowstek, Quebec, new station.
18. Sandy Island, Quebec, new station.
19. Nemaska, Hudson's Bay Company Post, Quebec, new station.
20. Marten Creek, Quebec, new station.
21. Portage Lake, Quebec, new station.
22. Netting Place, Quebec, new station.
23. Little Loon Lake, Quebec, new station.
24. Junction, Quebec, new station.
25. Mistassini Lake, Quebec, new station.
26. Misstassinny, Hudson's Bay Company Post, Quebec, new station.
27. Chibougaman, Quebec, new station.
28. Height of Land, Quebec, new station.
29. Swobmooswan, Quebec, new station.
30. Long Falls, Quebec, new station.
31. Mistassini, Quebec, repeat station.
32. Quebec, Quebec, repeat station.

Many delays as well as inconveniences were caused by the extremely bad weather; rain was encountered during almost the entire trip, especially from August 15 till October 3, during which time there was but one pleasant day. This was detrimental to the instruments and outfit, and a great deal of care was necessary to keep the instruments in even a fair condition. My men, in spite of assurances given, were found to be unfamiliar with the routes east of Rupert's House; it accordingly became necessary to secure additional guides and canoemen, but this was not easy, since the Indians were soon to return to the woods for their winter's hunt. At Nemaska it was possible to secure only one man, so the observer had to help in paddling the canoe in addition to looking after the scientific work; the computing had to be done in the evening by candle light. At Misstassinny, it was impossible to secure any guides at all, so the route through the lakes had to be found by means of a rough Indian map; about three days were lost between Misstassinny and Lac St. Jean, owing to the difficulty in following this map.

All computations were made in the field and kept up to date as nearly as possible. *Diurnal variation* observations in declination were made at five stations as follows: Abitibi Lake, Moose Factory, Sandy Island, Little Loon Lake, and Misstassinny, the interval, according to circumstances, being from 10 to 19 hours.

The only *magnetic storm* noted was on September 25, when it was almost impossible to make observations even with the dip circle. The observations on this day gave values of the magnetic elements quite different from the days before and after, which were reasonably quiet. Rain was falling for several days, both previous to and following this disturbance, so no northern lights were seen.

Especial mention must be made of the courtesies extended by the commissioner of the Hudson's Bay Company, Mr. C. C. Chipman, and, through his kind offices, by the various officials of the

company, who readily assisted the party in any way they could. The Trappist monks of Lac St. Jean at Mistassini were very liberal with their hospitality and helped the observer in every way possible.

C. C. CRAFT, ON MAGNETIC WORK IN BRITISH NORTH AMERICA AND ARCTIC REGIONS, JULY TO SEPTEMBER, 1908.

This work was made possible by special arrangement with Commander Peary, who for a stated sum agreed to furnish all required facilities. The writer was assigned to the expedition as magnetic observer, boarding the auxiliary supply-ship, the *Erik*, at Sydney; the vessel sailed on July 15, and returned to Brigus, Newfoundland, September 30, 1908. The instrumental outfit used was as follows: magnetometer No. 1, dip circle No. 35 with dip needles Nos. 1 and 2, and intensity needles Nos. 3 and 4; thermometers Nos. 2073 and 2788; pocket compass No. 2; tape No. 2; chronometer No. 257; tent No. 4; Eastman kodak No. 1A. From the list below, it will be seen that magnetic observations were secured in Nova Scotia, Newfoundland, Labrador, Baffin Land, and along the Greenland coast almost to latitude 80°. Not only were new magnetic data obtained, but secular variation results as well, along the entire route traversed by the *Erik*.

A great deal of bad weather was encountered; much fog in the vicinity of Labrador and Baffin Land, and rain and snow along the coast of Greenland. *Diurnal variation* observations in declination for shorter or longer periods were made as follows: At North Star Bay, August 2, 3, and 4, Kangerlooksoah, August 7, 8, and 9, and at Etah, August 12, 13, and 16.

The stations occupied were as follows:

1. Sydney, Cape Breton, Canada.
2. Hawk Harbor, Labrador.
3. North Star Bay, Greenland.
4. Kangerlooksoah, Greenland.
5. Etah, Greenland.
6. Etah, Auxiliary Station, Greenland.
7. Cape York, Greenland.
8. Upernavik, Greenland.
9. Hare Island, Greenland.
10. Godhavn, Disco Island, Greenland.
11. Holstenborg, Greenland.
12. Baffin Land (I).
13. Niantilik, Cumberland Sound.
14. Baffin Land (II).
15. W. Turnavik, Labrador.
16. W. Turnavik, Labrador, Auxiliary Station.
17. Seldom-come-by Harbor, Newfoundland.
18. Brigus, Cape Breton, Canada.
19. Charlottetown, Prince Edward Island, Canada.

At Nos. 1, 10, 15, 17, and 19 previous magnetic observations had been made.

W. H. SLIGH, ON MAGNETIC WORK IN CUBA AND CENTRAL AMERICA, NOVEMBER, 1908, TO JULY, 1909.

In accordance with instructions, I left Washington on November 20, 1908, bound for Cuba and Central America, with the following instrumental outfit: magnetometer theodolite No. 7, dip circle No. 172, pocket chronometer Kittel No. 256, Hamilton watch No. 71, magnetic observing tent No. 7, and miscellaneous accessories.

En route 2 stations in Florida were occupied. After observing at 14 stations in Cuba, I left Gibara, Cuba, on January 29, arriving at Belize, British Honduras, February 7, via New Orleans, where the necessary credentials were obtained from the various consuls of the Central American Republics. From Belize an expedition was made to Flores in northern Guatemala, the requisite passports having been furnished by Mr. C. Melhada, Guatemalan consul. From Belize to El Cayo, the journey was made by oil launch up the Belize River, and required 3 days and nights; at night, on account of obstructions in river, the launch could not proceed and was tied up along the bank.

Observations were made at El Cayo and mules and guide were secured here for crossing the Guatemalan forest to Flores. Traveling through the Guatemalan forest, owing to frequent swamps, was slow and difficult; there is no road, but only a trail through the thick undergrowth. The forests are very dense and the little Indian villages Yaxja and Macanché were the only available points between El Cayo and Flores for making observations. There is a scarcity of water, and no shelter was to be had at night; the region seems to be healthful, being cool and pleasant, especially at night. The Guatemalan officials were very courteous. The observations having been completed, the return was made, via El Cayo and Belize River, to Belize, arriving there March 13, the expedition to Flores having taken about a month's time.

At Belize a 15-ton sloop was chartered for a cruise along the east coast of Central America. It was manned by a skipper, pilot, and two sailors. Some difficulties as to landing at Iriona were removed by telegraphic order from the government to give aid and protection along all the coast. From Iriona, the cruise was continued to Cape Gracias, stopping at Point Patuca, thence to Bluefields, observing *en route* at Prinzapulca, where Mr. Adolf Kelting rendered much assistance by arranging for the landing of the party in a heavy sea. At Bluefields the crew and vessel were discharged on April 24, after being engaged 35 days; the voyage to Greytown was made on steamboat. Completing work at Greytown, the expedition was continued up the San Juan River by steamer to San Carlos, Nicaragua, thence to Corinto, on the west coast.

It was desired that an expedition be made up the Wanks or Coco River from Cape Gracias; but it is difficult to reach points further south from Cape Gracias and it seemed best under the circumstances to complete the coast work. It was also desirable that an expedition be made to Matagalpa and Ocotal, but on arriving in Managua, May 17, information was received that the rainy season had already commenced in that region. The road to Matagalpa is said to be good during the dry season and trails lead to points beyond, but, when rain sets in, the road becomes practically impassable.

Considerable difficulty was experienced in getting away from Corinto, owing to the uncertainty of boats; but finally, through the kindness of Captain Jones, of the steamship *Barracouta*, Amapala was reached; thence it was necessary to reach mainland by sail-boat, the town being on an island. From San Lorenzo a good road leads to Tegucigalpa and no difficulty was experienced in reaching that city. It was desired that the expedition be continued beyond Tegucigalpa, but weather conditions seemed unfavorable and so the return was made to Amapala. The magnetic elements were observed at La Union, Salvador, and at Amapala, Honduras; the trip was then continued to San Salvador via Acajutla. The officials in Salvador were uniformly kind and courteous. After observing at San José, Guatemala City, and Puerto Barrios, all instructions had been completed with the exceptions noted above.

Forty-five stations in all were secured, of which Miami, Havana, Gibara, Belize, San José were exact reoccupations of old stations and Guatemala City an approximate one. Observations had been made at Corinto by the British Navy, but the exact point could not be located; the old stations at La Union and Acajutla could not be reoccupied, hence new ones were established. In Cuba all stations, except those on the south coast, were easily reached. In Central America most interior points had to be reached by pack mules, and travel, owing to the very few roads, was difficult; facilities for reaching ports on either coast are meager, but better on the western than on the eastern coast. The cruise in a sloop along the east coast proved to be by far the most effective way of reaching the desired ports, though attended with difficulties.

Many kindnesses and courtesies were shown the observer, some of which have already been mentioned.

E. KIDSON, ON MAGNETIC WORK IN ECUADOR AND COLOMBIA, JULY, 1908, TO JUNE, 1909.

Acting in accordance with instructions of July 7, 1908, I left Washington on July 10, 1908, for Guayaquil, Ecuador, via New York and Colon, arriving there July 25. My outfit consisted of magnetometer 9, dip circle 178, pocket chronometer Kittel No. 252, magnetic observing tent No. 11, and miscellaneous appurtenances; the chronometer 252 being afterwards damaged was temporarily replaced by box chronometer Kittel 268 and finally by pocket chronometer Kittel 257. During overnight stoppage of steamer at Kingston, Jamaica, July 16–17, Mr. Fisk and I were able to get some determinations of the magnetic elements (see Mr. Fisk's report).

Magnetic observations were made at 13 stations in Ecuador, 23 in Colombia, and 3 in Panama. The stations at the point in Colon Harbor opposite Christobal and at Flamenco Island, together with the one at Kingston, had been previously occupied. Work was slow owing to lack of regular and frequent communication, extremely bad roads, etc. Returning to Guayaquil, the journey was continued to Esmeraldas and some observations were made at Manta on the way. Owing to a steamer being taken off the run for repairs it was necessary to stay at Esmeraldas for nearly a month. From Esmeraldas a short journey was made up the Esmeraldas River and a set of observations taken at the farthest point reached. After the return to Guayaquil, observations were obtained at Bahia, Manta, Salinas and Riobamba.

At Quito preparations were made for the long journey to Bogotá by mule. The roads were found to be in a wretched state owing to the advance of the rainy season, and delays were caused at every station in hiring fresh pack mules.

From Neiva to Girardot, on the Magdalena River, travel was by means of a raft and from Girardot to Bogotá part of the journey was on muleback and part by train. Returning to Girardot after some days at Bogotá, the journey to Barranquilla was undertaken by means of rafts, canoes, and river steamers. Crossing from Barranquilla by river steamer to Cienaga, and thence by steamer to Santa Marta, a wait of nearly a fortnight was encountered at the latter place for a schooner to Riohacha. Returning from the latter place to Santa Marta and Barranquilla, the trip was continued by steamer and train to Calamar and Cartagena and thence to Lorica and back to Cartagena on a small steamer. Proceeding to Colon, after a delay of three weeks, a steamer was obtained for Buenaventura and Tumaco. At the latter place a further delay was caused by the late arrival of the returning steamer and a short trip to Barbacoas was taken from Tumaco, going back to Panama and returning to Washington by way of Colon, Port Limon, and New Orleans.

In all 40 stations were occupied. All of the reductions were made in the field before the results were forwarded to Washington. As indicated by the horizontal intensity values, there seems to be a good deal of *local disturbance* in the country traversed. This to some extent is to be expected, owing to the line of active and extinct volcanoes along the length of the Andes. In Tulcan, at the close of the observations it was noticed that the volcanic ash which here covers the land contained large quantities of magnetite. The whole country from below Riobamba to beyond Tulcan is covered with ash. In Colon large changes were shown in the short distance between the two stations occupied and this region seems to be highly disturbed. Throughout the whole expedition much help was received from the governmental representatives in the various places, and from others interested in the work.

The outfit of an observer traveling in Ecuador and Colombia should be adjusted so as to be suitable for packing on mules. He should have riding and camping outfit, the latter including camp bed and mosquito net. Leggings or high boots should be worn as a protection against the many objectionable insects and snakes. Most of the outfit would probably best be obtained on the spot where requirements can be ascertained. Some knowledge of Spanish is absolutely necessary.

D. C. SOWERS, ON MAGNETIC EXPLORATION TRIP ACROSS CHINA DURING FEBRUARY TO OCTOBER, 1909.

In accordance with instructions of October 23, 1908, I sailed from San Francisco November 10, bound for Canton, China, via Honolulu, Yokohama, Kobe, Nagasaki, Shanghai and Hongkong. At Canton magnetometer comparisons were made in conjunction with Dr. C. K. Edmunds, who used C.I.W. magnetometer No. 2. Canton was left December 18 and, from December 19 to 25, comparison observations were made at the Hongkong Observatory. Leaving Hongkong December 26, and proceeding via Shanghai, Peking was reached January 4, where final preparations were made for the journey across China which began on January 30, 1909. While at Peking, the station established by Dr. Edmunds was reoccupied. Professor C. G. Fuson, of the Canton Christian College, joined the expedition, as chief assistant and companion, in Peking on January 25. Chow Hai Ting was employed as interpreter and when a Chinese cook was secured, the party, composed now of four persons in all, was complete.

The instrumental outfit consisted of the following: theodolite magnetometer No. 10, dip circle No. 171 with needles Nos. 5, 6, and intensity pairs Nos. 7 and 8 of D.C. 177, and 7 and 8 of D.C. 178, 7 being used for dip, pocket chronometer Kittel No. 251, Hamilton watches Nos. 70 and 3, small box chronometer No. 677, magnetic observing tent, two aneroid barometers, medicine chest, hypsometer with supply of alcohol, panoramic kodak, Eastman kodak No. 3, and miscellaneous appurtenances.

Leaving Peking January 30, we proceeded by rail to Honanfu, stopping a day at Chenchow to reoccupy the station where Dr. Edmunds had observed previously. From Honanfu onward, carts and pack animals were the means of travel and the average rate of progress was about 2½ to 3 miles per hour. The length of each day's march varied all the way from 15 to 30 miles.

The magnetic work proceeded without any difficulties whatever, observations being secured at 75 stations; only 6 of these could be reached by railroad or steamship. The weather was favorable throughout the entire journey. Stations were frequently located in the mission compounds.

The route followed was the Great North road across China, which was divided up into several big stages, each of which required a given number of days to make the journey. These stages were as follows: Honanfu to Sianfu, 10 days; Sianfu to Lanchowfu, 18 days; Lanchowfu to Suchow, 18 days; Suchow to Hami, 18 days; Hami to Urumtsi, 18 days; Urumtsi to Karashar, 18 days; Karashar to Aksu, 18 days; Aksu to Kashgar, 18 days; Kashgar to Khotan, 18 days. It was found practically impossible to make more than a regular day's stage each day; furthermore, it is customary to spend 3 days at each big stage to allow the animals to rest; where it was necessary to change the mode of travel, from carts to pack animals or vice versa, a delay of 10 days was usually necessary. The journey from Kargalik to Leh, India, usually requires about 22 days, but the high water in the mountain streams made them unfordable at times and our ponymen sought excuse for delay on every possible occasion; it therefore took us 30 days to make the journey, arriving in Leh, September 28. The 16 marches from Leh to Srinigar were made in 9 days, and 4 days later the railroad at Rawal Pindi was reached on October 13. Dehra Dun was reached by rail October 19 and comparison observations were made there until October 23. Leaving Bombay on October 30, and spending a few days in Europe *en route*, I returned to Washington on December 4, 1909.

An elaborate camping outfit was not found necessary in the greater part of China, since there are inns at nearly every place, where one can spend the night quite comfortably; experience showed that it was better to follow the customs of the country in this regard than to camp apart in the open field. Sufficient bedding, wrapped in rubber or canvas protective coverings while traveling, is a necessity and a light weight folding cot adds much to the comfort of such a journey. If a tent be taken, a small low one without walls, and with sides that slope down to the ground, like the tents used by camel drivers or ponymen, will be found most useful. Provisions such as canned milk, butter, jam, cocoa, chocolate, soups, must be carried along on extended interior trips. An interpreter and personal servant are essential members of a party. Nothing is gained in the time of traveling from one place to another by purchasing one's caravan. It will add greatly to the progress of an expedition if personal attention be given to all the little details of the work.

The winter months are most favorable for traveling in North China, especially as the climate is dry, the roads are good, and one can then be practically free from vermin. In the spring and summer months the roads become so muddy and boggy as to be almost impassable. The work in Chinese Turkestan could be done at any season of the year, the most favorable seasons being spring or fall; the heat is intense in summer and it becomes very cold in winter.

Throughout the entire trip, the party was treated with every courtesy. It will not be possible to mention every one by name to whom grateful acknowledgment is due; Chinese officials and custom house officers, the representatives of the British and of the United States governments, directors of the magnetic observatories visited, members of the Chinese Inland Mission, and various missionaries and private individuals, all united to give aid and assistance as needed. Sometimes a special escort, besides food and shelter, was provided by the reigning official. Due to such effective cooperation, the journey was accomplished according to schedule and without mishap.

SYNOPSES OF ADDITIONAL MAGNETIC SURVEYS, 1905–10.

Besides the surveys and trips briefly described in the foregoing extracts from field reports, the following work was undertaken during the period 1905–10.

D. C. Sowers. A six months' trip in 1905 through the Windward and Leeward Islands, the work closing at Caracas, Venezuela. Complete magnetic observations were made at 27 stations, at a number of which magnetic results had been secured previously, thus furnishing data for secular change.

G. Heimbrod. While associated temporarily with the Department of Terrestrial Magnetism, 1905–06, Mr. Heimbrod secured a valuable series of complete magnetic observations at stations distributed over various islands in the Pacific Ocean. He also made comparisons of his instru-

ments, before and after his field work, with those at Apia, Christchurch, Sydney, and Melbourne. The instruments used by him were courteously lent by the Apia Observatory; the observer-in-charge, Dr. Franz Linke, also gave Mr. Heimbrod the necessary instruction in observing. Mr. Heimbrod's stations were distributed as follows: Cook Island, 2; Samoan Islands, 1; Fiji Islands, 9; Society Islands, 3; Tuamotu Islands, 2; New Zealand and Australia, 6. Much of the transportation was effected by small sailing vessels. His work was greatly facilitated by the numerous courtesies extended by the governors of the various islands visited.

L. A. Bauer, E. H. Bowen, and P. H. Dike. In order to furnish data for the northward extension of the magnetic charts of the United States Messrs. Bauer, Bowen, and Dike, in September and October, 1906, determined the three magnetic elements at about 70 uniformly distributed stations in southern Canada between meridians 75° and 105° west. As the region was covered by Lefroy in his magnetic survey of 1842–44, important secular-variation data besides distribution results were obtained.

J. P. Ault. During December, 1906, to the early part of February, 1907, Mr. Ault made magnetic observations in Mexico at 17 stations, and secured comparisons with the standards of the Mexican Survey at the observatory at Cuajimalpa as also at Monterey.

C. K. Edmunds. The work for a general magnetic survey of China was begun by Dr. Edmunds in January, 1906, on Hainan Island. The instrumental outfit consisted of a Kew dip circle and a Kew magnetometer, with theodolite and tripods, kindly lent by the Hongkong Observatory, together with accessories supplied by the Department of Terrestrial Magnetism. The dip circle and magnetometer were standardized at the Hongkong Observatory both before and after field work. During the months of January and February, 8 stations were occupied on Hainan Island, in a region magnetically unexplored, and at some points which had never before been visited by a white man. In May, 1906, an outfit of small French instruments was borrowed from the Zi-ka-wei Observatory, through the courtesy of Director Le Froc, and compared at the Hongkong Observatory with the Kew instruments used in the early part of the year. With these small instruments a magnetic survey was made along the coast from Swatow northward during June, July, and August, 12 stations being occupied. At irregular times during the year, as opportunity afforded, 11 stations were obtained in the vicinity of the lights in the Chusan Archipelago and in the neighborhood of Chefoo, Tientsin, and Naichwang. Between November, 1906, and January, 1907, comparison observations were made at Hongkong and Honglok, and during February, 1907, magnetic observations were made at Honglok, Yeungkong, Kochow, and Foochow. A new outfit of instruments was supplied by the Department of Terrestrial Magnetism in 1907 and compared with the Kew and French instruments used in the previous work. During August to December, 1907, and between October 1 and December 15, 1908, about 35 stations were occupied in the provinces of Kiangsi, Kiangsu, Shantung, Chihli, Shengking, Honan, and Hupeh, thus completing a fairly detailed survey of the southeastern part of China, between approximately the meridians 113° and 122° east and parallels 22° and 42° north. On October 1, 1910, a campaign was initiated for extending the magnetic work into the provinces of Kwangsi and Yunnan and into Indo-China. Since the work is still in progress, a detailed report is at present deferred. As Dr. Edmunds is president of the Canton Christian College at Honglok, he has been able to give only a part of his time to the work — about three to four months each year. The total number of his stations up to 1910 was about 100, a number of which were repeat stations.

J. C. Pearson and W. H. Sligh. In pursuance of instructions, Mr. Pearson left Washington the latter part of February, 1908, for Constantinople, stopping *en route* at the Kew Magnetic Observatory, for comparisons of his instruments with the Kew standards. Upon arrival at Constantinople, he determined the magnetic elements at a station in the grounds of Robert College and then proceeded to Egypt, securing observations at Port Said, Suez, Alexandria, and comparisons at the Helwan Magnetic Observatory near Cairo. After the work in Egypt, he returned to Constantinople and then entered on the trip to Persia, via Tiflis, Russia. Observations were made at Alexandropol, Erivan, Nakhitchevan, and Batum, and comparisons were secured at the Tiflis Magnetic Observatory. Persia was entered at Khoi, on the northern frontier, and magnetic observations were made at Khoi, Tabriz, and Teheran, also at 4 stations between Tabriz and Teheran. The work was continued from Teheran mainly by camel caravan, but owing to unsettled political conditions there were numerous delays. Altogether 13 stations were occupied

in Persia after leaving Teheran, 1 at Gwadur, Baluchistan, 4 in Arabia, 1 at Basra, Asia Minor, 20 in Asiatic Russia, and 11 in European Russia, as also a reoccupation of the station at Constantinople. June 28 to July 3, 1909, he once more compared his instruments at the Tiflis Magnetic Observatory and in the following September made comparisons of his instruments with those of the Tashkent Observatory. After an expedition along the southern coast of the Black Sea in Turkey in Asia, he returned to Constantinople. Upon completion at Constantinople of comparisons with instruments brought from Washington by Observer W. H. Sligh, he returned to Washington, March 26, 1910. On his homeward journey he obtained a valuable series of comparisons of the standards of the Department of Terrestrial Magnetism with those of the observatories at Pola, Potsdam, Kew (a second time), and Cheltenham, Maryland.

Mr. Pearson, in addition to the observations at magnetic observatories, had determined the magnetic elements at about 130 stations, in regions chiefly where no previous data had been obtained; some of his stations were reoccupations and hence secular changes were also obtained. Much delay ensued at times, caused by the unsettled political conditions in Asiatic Turkey and Persia when the expedition was in progress; the various difficulties were, however, successfully overcome.

Acknowledgment is due the representatives of the Turkish, Persian, Russian, English, and American governments for special courtesies extended, as also to General M. Rykatcheff, and to the directors of the various observatories, where the intercomparisons were made. The treasurer of the American Missions in Turkey, Mr. W. W. Peet, assisted in the transfer of funds to the party. Mr. Dimiter V. Pehlivanoglou accompanied the expedition as interpreter and assistant. After Mr. Pearson left the field, the work was continued by Mr. Sligh in European and Asiatic Turkey, about 75 stations having been occupied by the end of 1910; some of these were repeat stations. Mr. Sligh's work is still in progress.

E. Kidson. Before joining the *Carnegie* at St. Johns, Newfoundland, Mr. Kidson, in August and September, 1909, determined the magnetic elements at 1 station in New Brunswick, 1 in Nova Scotia, and 17 in Newfoundland, 4 of which were repeat stations.

C. C. Stewart. Beginning in August, 1910, a valuable series of magnetic stations was secured along the Amazon and Ucayali Rivers using the launch *El Imán* purchased by the Department of Terrestrial Magnetism. The first station was at Manáos, Brazil, at which observations had been made previously by others. About 21 stations were then occupied between Manáos and Iquitos, Peru. From Iquitos the work was extended along the Ucayali River, observations having been made at 12 stations, also at 3 in Peru, along the Marañon River. The work was continued in 1911. [This series of stations across South America was completed in 1912 by Mr. H. R. Schmitt of Mr. J. P. Ault's party.]

1. Station at Leh, India.

2. Station at Bogota, Colombia.

3. View from Station at Kizil Langar, India.

4. Station Amazon 9, Brazil, showing Survey Launch "El Iman."

5. Station at Rumeli Hissar, near Constantinople, showing the Bosphorous.

6. Magnetic Camp at Mamakhatun on Banks of the Tuzla Su, Armenia.

Typical Field Views by Observers in South America, India, and Asia Minor.

DESCRIPTIONS OF STATIONS.

One of the chief difficulties experienced by the Department in the reoccupation of old stations for secular variation data has been the lack of necessary information to permit precise recovery of the point where the previous observations were made. Owing to the frequent occurrence of local disturbances, it may readily happen that erroneous secular variation data will result from non-recovery of exact station. Accordingly the observers of the Department are instructed to furnish as complete descriptions as possible of stations occupied, especially of such as give promise of future availability. Information additional to that contained in the published descriptions or copies of station-sketches or of photographs of surroundings will gladly be furnished those who are interested in the reoccupation of any of the stations.

The descriptions are given in alphabetical order under the same geographical divisions adopted in the Summary of Results. The general form followed in the descriptions is: Name of station, year when occupied, general location, detailed location, distances and references to surrounding objects, manner of marking, and finally the true bearings of prominent objects likely to be of permanent character. All bearings unless specifically stated otherwise are true ones and are reckoned continuously from 0° to 360°, from the south through the west. Occasionally no description of a station listed in the Summary will be found; this is because the description as furnished by the observer, for one reason or another, was too meager to be worth publishing or it may be that the station was only a temporary one and was used chiefly as an auxiliary or secondary station. For some expeditions, as for example in Africa and Asia, owing to the absence of surrounding objects to which reference could be made, the descriptions of stations naturally could not be made very full or precise. When no mention is made of marking of station, it is to be understood that the station was either not marked at all or not in a permanent manner.

The majority of the measured distances were made originally in the English system; however, the distances obtained by conversion into the metric system are also given but inclosed in parentheses so as to show that they are converted figures. The following rules have been adopted in the conversions: distances given to 0.01 foot are converted to the nearest 0.001 meter, 0.1 foot to the nearest 0.01 meter, 1 foot to the nearest 0.1 meter, estimated feet or yards to nearest meter, estimated fraction of a mile to nearest 0.1 kilometer, estimations of more than a mile to nearest kilometer. Short and important reference distances, when measured accurately, have been converted into nearest 0.1 centimeter; such measurements, however, as for example, dimensions of marking stones, etc., which are not of great importance, have been converted to the nearest centimeter.

AFRICA.

BRITISH EAST AFRICA.

Athi River, 1909.—267 yards (244 meters) south of railway line at right angles from a point 82 yards (75 meters) east of east water tank and 162 yards (148 meters) east of middle of station house.

Elburgon, 1909.—Northeast of railway station, on grass between railway and the wood, 250 yards (229 meters) from southeast side of small wooden fence around station houses.

Elmenteita, 1909.—205 yards (187 meters) west of main railway line, measured from a point 33 yards (30 meters) north of telegraph pole 428–12, which is the first south of railway station.

English Point, Mombasa, 1909.—On the north shore of channel at Mombasa, on west side of a path leading from steps at English Point east-northeast to a small iron house at the beginning of the rifle range; it is 244 yards (223 meters) from the steps and 29 yards (27 meters) at right angles from path.

Fort Ternan, 1909.—Northwest of railroad, 167 yards (153 meters) at right angles from west end of siding.

Gilgil, 1909.—Southwest of railway 220 yards (201 meters) measured from a point 210 yards (192 meters) southeast from middle of railway station.

Kapiti, 1909.—267 yards (244 meters) at right angles from railway line from a point 194 yards (177 meters) southeast from middle of station house.

Kibigori, 1909.—232 yards (212 meters) north of the railway main line and 5 yards (5 meters) east of path which runs north from station.

Kijabe, 1909.—216 yards (198 meters) at right angles southwest of main track of railway, measured from a point 166 yards 152 (meters) from middle of station house.

Kiu, 1909.—On the side of slope southwest of railway line, 201 yards (184 meters) from track, measured from a point 148 yards (135 meters) southeast of middle point of station house.

Lamoru, 1909.—409 yards (374 meters) from south end of freight house, 36 yards (33 meters) west of wagon track at foot of bluff rising abruptly on east side of railway and 165 yards (151 meters) from main track.

Londiani, 1909.—On the slope between railroad and river; 54 yards (49 meters) to left of point 337 yards (308 meters) from east water tank, measured along path running northeastwardly through village.

Lumbwa, 1909.—On the slope northwest of railway station; 40 yards (37 meters) above broad metaled path running from railroad to large house west of station house, measured from a point 275 yards (251 meters) along path from main track.

Mackinnon, 1909.—197 yards (180 meters) northeast of railway main line, at right angles from point 190 yards (174 meters) west of station house.

Makindu, 1909.—410 yards (375 meters) southwest of railway station, on prolongation of short roadway leading directly from building.

Masongaleni, 1909.—In the clearing 250 yards (229 meters) west from station house.

Maungu, 1909.—176 yards (161 meters) at right angles northeast of main railway line from a point 132 yards (121 meters) southeast from middle point of station house.

AFRICA.

BRITISH EAST AFRICA—*continued.*

Mazeras, 1909.—300 yards (274 meters) northeast of railway measured along a road running through village at right angles to track from south end of railway station; 20 yards (18 meters) to left of road and near a small stream.

Mtito Andei, 1909.—284 yards (260 meters) 49° west of north from railway station, in small open space near edge of scrub; approximately 165 yards (151 meters) west of railway track.

Nairobi, 1909.—267 yards (244 meters) southeast of fence inclosing station grounds, 101 yards (92 meters) east of path running southward from east end of fence, measured at a point 245 yards (224 meters) south of railway.

Naivasha, 1909.—On north side of path and 266 yards (243 meters) east from railway main track, from a point 36 yards (33 meters) south of south water tank; on the plain sloping gently up from east shore of Lake Naivasha.

Nakuru, 1909.—On north side of railway, opposite east end of station house and 350 yards (320 meters) north of fence inclosing station and sidings.

Port Florence, 1909.—East of railway station and 216 yards (198 meters) southeast of cotton ginnery, the nearest building; in range with northeast end of cotton ginnery and highest point of further ridge to northwest.

Samburu, 1909.—208 yards (190 meters) at right angles from a point on main railway track 84 yards (77 meters) west of station house.

Simba, 1909.—282 yards (258 meters) south of railway line, at right angles from a point 163 yards (149 meters) east from station house.

Sultan Hamud, 1909.—241 yards (220 meters) at right angles south from a point on main railway line 320 yards (293 meters) east of middle point of station house.

Tsavo, 1909.—Southwest of railway, 184 yards (168 meters) at right angles from point on railway 167 yards (153 meters) northwest from middle of station house.

Voi, 1909.—Southeast of railway station and between railway and river; 100 yards (91 meters) to left of path crossing main track and siding 106 yards (97 meters) from end of railway inclosure, the first measurement being from a point in path 282 yards (258 meters) from siding.

Zanzibar, Zanzibar, 1909.—In a meadow on east side of street which runs south in front of British Consulate, from the Royal and Grand Hotels, and past monument of General Matthews and the large Indian cemetery; 62 yards (57 meters) from road, measuring at right angles from a point 109 yards (100 meters) south of monument.

BRITISH SOUTH AND CENTRAL AFRICA.

Aggennys, Cape Colony, 1909.—At the mouth of a kloof, 30 paces to right of a point in road from O'okiep 110 paces from river bank toward Pella.

Alewynsfontein, Cape Colony, 1908.—On right of road from Nieuwefontein, on bank of river bed near road, about 500 yards (457 meters) north of two water holes and two ridges of kopjes perpendicular to road.

Augsburg, Cape Colony, 1907.—To right of road from Augsburg to Van Rhynsdorp, just at edge of wood and 50 yards (46 meters) in direction of Van Rhynsdorp from junction of two roads.

AFRICA.

BRITISH SOUTH AND CENTRAL AFRICA—*continued.*

Aus, Cape Colony, 1909.—Just under a sand dune to right of road from O'okiep, 80 paces toward Sabies from a point halfway from water-hole to road.

Beukesfontein, Cape Colony, 1908.—In bed of Beukesfontein River, to right of road from Ceres, about 120 paces from middle of drift, in green patch of sedge alongside the garden and beyond sheep kraal.

Blantyre, Nyassaland, 1909.—In field northeast of Manadala Boarding House, 157 yards (144 meters) east of road which runs north from boarding house, and opposite a point on road 100 yards (91 meters) north of front steps.

Brak Rivier, Cape Colony, 1908.—To right of road from Calvinia, and on side of river opposite Brak River farmhouse, about halfway between graveyard and bank of river where the road crosses.

Broken Hill, Northwestern Rhodesia, 1909.—About 5 paces east of a Kaffir path running nearly south from present position of railway station, now near the Broken Hill mine hillock and about a mile (1.6 km.) from the township; 163 paces from railway, measured southeastward at right angles from a point 55 paces toward Livingstone from position marked 2013¾ miles from Cape Town.

Bulawayo, Southern Rhodesia, 1909.—Two stations occupied: first on cement pillar in magnetic observing house at Bulawayo observatory, in charge of Father Goetz; second station 34.7 feet (10.57 meters) 36° 51′ west of true south from southwest corner of cement pillar in magnetic observing house.

Cape Town, Cape Colony, 1908.—The two stations were near the Royal Observatory in general neighborhood of station of Prof. J. C. Beattie in 1905, which was under a large tree on Cape Town side of new transit house of the Royal Observatory.

Ceres, Cape Colony, 1908.—To right of road from Ceres Road to Ceres, 100 paces from road and perpendicular to it, measured from Ceres Road end of straight part of road going into Ceres Village.

Ceres Road, Cape Colony, 1908.—In general neighborhood of station of 1900.

Choma, Northwestern Rhodesia, 1909.—Southeast of railway line, on rifle range, 38 yards (35 meters) from backmost shooting-place.

Cradock, Cape Colony, 1908.—In vacant space north of convent school, about 200 yards (183 meters) east of cemetery gates, and about 400 yards (366 meters) from convent school grounds.

Draaikraal, Cape Colony, 1908.—On bank of river, to left of road to Calvinia, north of farmhouse, and 110 paces from road at a point opposite a number of graves.

Eendekuil, Cape Colony, 1907.—The station is reached by going 15 paces from 128-mile post away from Cape Town and then at right angles to railway across river bed about 15 paces from river bank.

Fife, Northeastern Rhodesia, 1909.—6 yards (5 meters) southeast from rifle range, 33 yards (30 meters) from second shooting-mound, 125 yards (114 meters) from first and 137 yards (125 meters) from edge of road running behind the Boma from assistant magistrate's house to residence of the magistrate.

Fort Hill, Nyassaland, 1909.—13 yards (12 meters) west of path running south from stockade around brick office building and 150 yards (137 meters) from porch of office.

AFRICA.

BRITISH SOUTH AND CENTRAL AFRICA—*continued.*

Fort Rosebery, Northeastern Rhodesia, 1909.—Observations made at two points; first on grass plot 70 paces north of end of storehouse beside avenue leading north from magistrate's office toward river; the second in same plot about 15 paces nearer river.

Gabis, Cape Colony, 1909.—On opposite side of river from the mission, between river and two roads from Haib and Warmbad respectively, which unite near stone marked 28 kilometers from Haib, 65 paces to left of a point in line joining kilometer stone and grave of Reiter Rogler, 57 paces from latter.

Gansfontein, Cape Colony, 1908.—About 140 paces to right of road from Ceres, between first and second of three acacia trees before and about 20 paces from a spring of sulphur water.

Ginginhlovu, Natal, 1908.—In general neighborhood of station of 1903, on east side of railway, near platform.

Hutchinson, Cape Colony, 1908.—Station of 1898 approximately reoccupied; it is across railway from hotel, about one-half mile (0.8 kilometer) from railway station, at right angles to platform.

Illovo River, Natal, 1908.—In general neighborhood of station of 1903, on west side of railway, about opposite railway station.

J. T. M. No. 80, Northeastern Rhodesia, 1909.—120 yards (110 meters) to left of path from Abercorn to Fife, measured from a point on path 70 yards (64 meters) from south end of bridge over Saisi River.

Kalomo, Northwestern Rhodesia, 1909.—Northeast of railway station and about 150 yards (137 meters) east of Kaffir hut used as store. The following true bearings were determined: northwest pillar of water tank, distant 810 feet (246.9 meters), 39° 56′; east pillar of Kaffir hut used as store, 81° 50′.

Karonga, Nyassaland, 1909.—Under southwest side of a big tree on north side of and close to road, about 120 yards (110 meters) west of the Boma.

Klipfontein, Cape Colony, 1909.—546 yards (499 meters) north of back of large house north of railway and close to watertank; the middle of back or north chimney of house is in true bearing 357° 09′.0.

Koppeskraal, Cape Colony, 1908.—To left of road from Calvinia, near farmhouse.

Kweekfontein, Cape Colony, 1909.—To right of road from Concordia, about 50 yards (46 meters) distant at right angles from a point in range with cluster of three large boulders beside an isolated kopje near river bed.

Leeuwenfontein, Cape Colony, 1908.—On the farm Leeuwenfontein, to right of road and about 30 paces from fourteenth milestone from Ceres Village.

Leeuwriet, Cape Colony, 1907.—On Calvinia side of farm, to left of road from farm to main road and near junction of the two roads.

Livangwe, Nyassaland, 1909.—88 yards (80 meters) along a path towards the village from main road, measured from a point 50 yards (46 meters) from the stream on side opposite the rest house.

Livingstonia, Nyassaland, 1909.—At Kondowe mission station, at crossing of two roads just beyond stone residence of chief of mission.

Luwingu, Northeastern Rhodesia, 1909.—Observations were made at two points. The first station is within triangular campus 220 feet (67.1 meters) from east pillar of magistrate's office, which stands at southwest apex

AFRICA.

BRITISH SOUTH AND CENTRAL AFRICA—*continued.*

Luwingu, Northeastern Rhodesia, 1909—*continued.* of the triangle, and 315 feet (94.0 meters) from southwest corner pillar of the magistrate's residence, which stands at southeast apex. The second station is 37.5 feet (11.43 meters) northeast of first, in line with magistrate's office.

Modder River, Cape Colony, 1908.—To right of railroad from Kimberley to Orange River, between the slaughter sticks and the graveyard near hotel and 100 paces from corner of graveyard nearest slaughter sticks.

Mpezi, Nyassaland, 1909.—On south side of path leading to village from main road near the rest house and 175 yards (160 meters) along path from main road.

Mporokoso, Northeastern Rhodesia, 1909.—To right of path going from the Boma to travelers' house, about 60 yards (55 meters) from carriers' quarters.

Mpunzi, Nyassaland, 1909.—On southwest side of road at Mpunzi Mission, 80 yards (73 meters) northwest of brick schoolhouse and 6 yards (5 meters) west of front line of schoolhouse produced.

Mulungushe, Northwestern Rhodesia, 1909.—On north side of Mulungushe River, to left of path to Ndola, 200 yards (183 meters) along path from river.

Muona, Nyassaland, 1909.—Under a great tree close to east side path crossing Muona River at Muona village, 143 yards (131 meters) along path south from stream.

Naauwpoort, Cape Colony, 1908.—Near station of 1901, about 600 yards (549 meters) west of railway station and about 400 yards (366 meters) on other side of sluit from hotel.

Ncheu, Nyassaland, 1909.—West of main road and 25 yards (23 meters) at right angles northwesterly from path leading from main road to office, measured from a point 63 yards (58 meters) from main road.

Ndola, Northwestern Rhodesia, 1909.—About 40 yards (37 meters) southeast of magistrate's house.

Newcastle, Natal, 1908.—In Incandu Park, near end of bridge and opposite end of racing track.

Ngara, Nyassaland, 1909.—31 yards (28 meters) east of path running from magistrate's house to door of courtyard of magistrate's office, measured from point on path 165 yards (151 meters) from door of courtyard.

Nieuwefontein, Cape Colony, 1908.—On west river bank between a house on east, built of brick and covered with corrugated iron roof, and a white house with thatched roof on west.

O'okiep, Cape Colony, 1908, 1909.—About half a mile (0.8 kilometer) from house of Dr. Howard, near which observations were made in 1874, on golf links on eastern side of clump of gum trees behind house of the manager of Cape Copper Company. The following approximate magnetic bearings west of south were determined: highest point on Sugarloaf Hill, 359° 55′; middle of crusher chimney, 66° 51′; flagstaff at Fort Shelton, 147° 45′.

Orange River, Cape Colony, 1908.—In general neighborhood of station of 1902, about 600 meters due west of railway station.

Ougrabies, Cape Colony, 1909.—30 paces to left of road from Kweekfontein, on a line joining summits of a large beaconed hill near water hole and one on opposite side of road and nearer Kweekfontein.

AFRICA.

BRITISH SOUTH AND CENTRAL AFRICA—*continued.*

Papekuil, Cape Colony, 1908.—About 50 paces to right of road to Calvinia and 100 paces north of path leading to sulphur spring.

Paswedza Nyassaland, 1909.—80 yards (73 meters) east of road, under a banyan tree and opposite a point on road 100 yards (91 meters) north of stream.

Pella, Cape Colony, 1909.—To right of road from Aggennys, midway between two large kameelboom trees, at a point 412 paces from church and 538 paces from middle of river bed.

Pemba, Northwestern Rhodesia, 1909.—186 feet (56.7 meters) west of a conspicuous ant hill which is surmounted by a Kaffir hut used by a white storekeeper, about 150 yards (137 meters) east of railway station. The following true bearings were determined: northeast front corner of Mr. Thorne's cottage, distant 601 feet (183.2 meters), 161° 57′; northeast front pillar of station master's house, 143° 53′.

Piet Potgietersrust, Cape Colony, 1908.—To left of railway from Pretoria to Pietersborg, 120 paces from railway, measured at right angles from a point on railway 224 paces towards Pretoria from end of platform.

Plaatklip, Cape Colony, 1908.—On farm of this name. The road, after coming through a pass, has on its left a number of very large boulders forming a peculiar kopje; the station is 20 paces to right of road from Louriesfontein, in line with continuation of kopje.

Port Herald, Nyassaland, 1909.—North of grounds about store and house of the African Lakes Corporation, in open space 193 yards (176 meters) west of railway, measured from a point 83 yards (76 meters) north of front of house.

Port Nolloth, Cape Colony, 1909.—51 yards (47 meters) east of path running between beach and piece of government ground called the plantation, near beacon which marks south boundary of the bar, and 650 yards (594 meters) south of flagstaff in front of magistrate's office. The following true bearings were determined: flagstaff in front of magistrate's office, 162° 37′.0; gable of house on beach, 00° 40′.0.

Pretoria, Transvaal, 1908.—In general neighborhood of station of 1903, in open space between race course and end of Schoeman Street.

Rahman's Drift, Cape Colony, 1909.—About 150 paces from bank of Orange River, on a raised tongue of land between the new and old roads into Rahman's Drift from O'okiep.

Rietfontein, Cape Colony, 1908.—To left of road from Alewynsfontein, at intersection of lines joining two highest kopjes on east and west and two highest on north and south

Sakontwi, Northeastern Rhodesia, 1909.—On Luapula River, about 200 yards (183 meters) beyond where path towards Fort Rosebery leaves native gardens.

Stompiesfontein, Cape Colony, 1908.—50 paces to left of road to Calvinia and 30 paces south of footpath leading from road to some muddy pools.

Victoria Falls, Rhodesia, 1909.—The old station was reoccupied and a new station established. The first is on Bulawayo side of water tank, 83 paces at right angles from railway line, measured from a point 79 paces along railway from tank. The new station is in Falls Park, 60 paces to right of path from present hotel to Devil's Cascade, measured from a point in path 143 paces before it recrosses railway near bridge over Zambesi River.

AFRICA.

BRITITH SOUTH AND CENTRAL AFRICA—*concluded.*

Windhoek, Cape Colony, 1907.—About 50 paces from road, to left of path, and 20 paces back from furrow to garden in direction of hotel.

Zimba, Northwestern Rhodesia, 1909.—Southeast of railway line, 508 feet (154.8 meters) from point under east end of ridge of ganger's house, which bears 86° 42′ west of south.

EGYPT.

Alexandria, 1909.—At Koor, about 7 miles (11 kilometers) northeast of Alexandria; on coast about 2 kilometers across the desert from the Khedive's mother's palace and end of electric tram line. Directly in front of station is a sandstone ledge known as the "spouting rock." Otherwise the surrounding country is all a sandy desert. The point is marked by a brass bolt 2 inches (5 cm.) in diameter and 4.5 inches (11 cm.) long set in a concrete post 30 by 30 by 80 cm. and projecting 5 cm. above ground. An arrow carved in top of post indicates approximate north. The following true bearings were determined: left or outer tower of Khedive's palace El Mantaza, distant 4 km., 230° 24′.8; minaret of mosque El Mandara, distant 4 km., 242° 45′.8; minaret of mosque Sidi Beshur, distant 1 km., 19° 32′.8; spire on El Serai, Khedive's mother's palace at Ramleh, distant 2 km., 38° 19′.7.

A secondary station was established 384 feet (117.0 meters) southwest of main station on a line joining main station and tower on palace of the Khedive's mother.

Helwan, 1908, 1909.—Observations for dip were made on north and south piers in porch of Helwan Magnetic Observatory, and for declination and intensity on north pier in porch and on north pier in the absolute house. Simultaneous observations were made with the observatory instruments and stations interchanged. The true bearings of the marks used were furnished by the observatory authorities as follows: white stone from north pier in porch, 176° 24′.0; mark from north pier in absolute house, 300° 58′.4.

Port Said, 1908.—On old seawall directly in front of the Gouvernorat, at a point nearly buried in the sand, about on a level with road running along water front, about 125 meters from nearest building and a little less than 125 meters from the water; marked by a brass bolt about 4.5 inches (11 cm.) long and 2 inches (5 cm.) in diameter at top projecting about 0.2 inch (0.5 cm.) above stone and cement in which it is set. The intersection of a cross in top of bolt marks the station. The following true bearings were determined: De Lesseps Monument (back of head), 270° 33′.6; Catholic Church spire, 349° 54′.8; Abyssinian Church spire, 30° 48′.3; minaret of mosque, 64° 30′.7; flagstaff on beacon, 102° 31′.9.

Two secondary stations were established. One to northward, designated N Station on beach 193 feet (58.8 meters) from main station, on line from main station to Catholic Church spire, and 48 feet (14.6 meters) from iron mark set in block of concrete, bearing 49° 05′ west of north, and marked "1000 km."

The other secondary station designated E Station is eastward on beach 338 feet (103.0 meters) from main station and on line from main station to De Lesseps monument. The secondary stations were marked with pegs.

Suez, 1908.—On the low desert west of town of Suez, 116 meters north of small brick structure close by old lighthouse; marked by brass bolt 4.5 inches (11 cm.) long and 2 inches (5 cm.) in diameter at top set in cement in top of sandstone post 20 by 25 by 80 cm. projecting about 5 cm. above ground and finished off square with cement. The precise point is the intersection of cross cut in top of bolt. The following true bearings were determined: spire on Mosque Ibrahim Bey Gilidan, distant 2 km., 213° 54′.7; minaret of Mosque Abul-Eef, distant 2 km., 238° 32′.3; spire of Catholic Church (Port Tewfik), 313° 13′.1

AFRICA.

EGYPT—*concluded.*

Suez, 1908—*continued.*

GERMAN EAST AFRICA.

Bismarckburg, 1909.—On north side of road, 120 paces east of gate of the Boma, which stands on a point of land projecting into Lake Tanganyika.

Dar-es-Salaom, 1909.—The observations were made in the magnetic house of Meteorological Haupt-Station, in a meadow close to the sea.

Gera, 1909.—In camping ground on north side of house reserved for Europeans and alongside stockade on east.

J. T. M. No. 138, 1909.—At siding 118.7 kilometers from Dar-es-Salaam; 150 yards (137 meters) south of railway line and behind telephone house.

Kalambo River, 1909.—About 18.5 miles (30 kilometers) from Abercorn, on road from Abercorn to Bismarckburg, in a native garden just before reaching bridge across the Kalambo.

Kanazi, 1909.—On east side of camping ground and south of rest house built for Europeans.

Kapoli, 1909.—On west side of village, under a big tree, about 100 paces from stockade.

Kasusiwakaie, 1909.—About half a mile west of village, just on edge of cultivated field. Victoria Nyanza, distant about 13 miles (21 kilometers), is visible from this station.

Katé, 1909.—On right bank of Katé River, on east slope of hill on which Katé village is situated, and beyond second of two springs.

Katoki, 1909.—North of camping ground, to right of main road from Tabora to Bukoba.

Kilossa, 1909.—On a hill 623 paces north of south face of railway station and in line with west furrow of street running north from railway station.

Mabuku, 1909.—About 100 paces to right of road from Tabora and just to right of path from main road to village.

Misuruti, 1909.—To left of road from Usuvi to Bukoba, against southern stockade on upper or western side of camp.

Mkatta, 1909.—Magnetically north of west end of railway station and 236 yards (216 meters) from south pillars.

Morogoro, 1909.—On east side of stream running between market place and police station, 293 yards (269 meters) south of road, measured from a point 32 yards (29 meters) west of middle door of police station and 80 yards (73 meters) east of bridge.

Mpimbwe, 1909.—On camping ground on Kakole side of village, about one mile from hot spring.

Mrewa, 1909.—In inclosure on east side, close to stockade.

Mwinyisagara, 1909.—On the rising ground south of a flat on south side of railroad, 295 yards (270 meters) from front pillars of railway station.

Nakasikwi, 1909.—Under a big tree about 150 paces northeast of village in a banana grove at the foot of a hill.

AFRICA.

GERMAN EAST AFRICA—*concluded.*

Ngere-Ngere, 1909.—Southeast of railway station, in a path forming a continuation of a short street running off from rear of railway station to a street that runs parallel to railway; 56 yards (51 meters) south of the cross street, 18 yards (16 meters) beyond a large baobab tree, and 415 yards (379 meters) from front pillars of railway station.

Njanda, 1909.—60 paces west of the ford and 20 paces from right bank of river, above the ford.

Polumko, 1909.—On Sopa side of a big tree on camping ground, on Sopa side of village.

Ruvu, 1909.—240 yards (219 meters) north of railway station house and 10 yards (9 meters) west of road running about north to cotton plantation called Ruvu Thal, about two-thirds mile (1 kilometer) distant.

Soga, 1909.—South of the railroad, 175 yards from main track.

Sopa, 1909.—On west side of camping ground, on northwest side of village.

Tabora, 1909.—On east side of Bahnhofstrasse in a grove of mango trees used at times as a camping place, about 100 paces southwest of regular camping place and about one-half mile (0.8 kilometer) north of the Boma.

Tekanda, 1909.—Under a big tree about 200 paces northwest of village and west of the pool.

Ugolole, 1909.—About 80 paces west of stockade surrounding village, under a large tree.

Ukamba, 1909.—To right of road from Tabora, under a big tree on north side of camp; there is a granite kopje to the east.

Urumwa, 1909.—On camping-ground, 20 paces to right of road from Mpangalle to Tabora.

Usuvi, 1909.—Northwest of German post, midway between back of present magistracy and summit of hill on which it is built.

GERMAN SOUTHWEST AFRICA.

Aris, 1909.—West of road from Rehoboth, 155 paces from a guide post exactly opposite.

Aus, 1909.—To right of railway to Seeheim, 10 paces to left of Kubub road at a point 280 paces beyond the European hospital.

Awasap, 1909.—On west side of main transport road from Gibeon to Rehoboth, opposite the outspan, on north side of river and in range between door of a store and kilometer stone marked "From Rehoboth 23 km."

Buchholzbrunn, 1909.—On north side of railway and west of road to Bethanien; 256 paces from station house and 110 paces from kilometer stone 21 on Bethanien road.

Dickdoorn, 1909.—50 paces to right of road and about 150 paces from north bank of Garigab River.

Ebony, 1909.—On south side of railway at a point from which east end of station house roof ridge is in true bearing 114° 13′.4.

Epako, 1909.—On northwest side of railway line, on the far side of small valley with a dry bed. The west pillar of station house veranda, distant 151 yards (138 meters), is in true bearing 322° 50′.

Erongo, 1909.—South of railroad and about 213 yards (195 meters) from station house, the front east corner of which is in true bearing 98° 55′.2.

AFRICA.

GERMAN SOUTHWEST AFRICA—*continued.*

Garakanas, 1909.—About 50 paces to right of road to Spitzkopp and opposite large house built as a veterinary station.

Garub, 1909.—190 paces to left of railway to Lüderitzbucht, measured from a point 193 paces west along railway from water tanks.

Gawachab, 1909.—200 paces west of railway, behind station master's house.

Gibeon, 1909.—About 50 paces toward Gibeon from summit of middle one of three hills, situated on north bank of a small stream tributary to Fisch River from the east; on northeast corner of the outspan and east of road to Jakalsfontein.

Gobas, 1909.—152 paces north of railroad and 183 paces east of kilometer stone on wagon road marked 9 kilometers from Keetmanshoop.

Gründoorn, 1909.—Due east of southeast corner of Mrs. Hill's house (the corner nearest the well) and due south of kilometer stone No. 130 from Keetmanshoop.

Haribes, 1909.—50 paces to right of main transport road from Gibeon to Kub, across from telegraph line and opposite the more southern of two kopjes called "Klein Haribes."

Holoog, 1909.—250 paces east of railway in range between south end of railway station and south end of flat-topped mountain east of railway.

Jakalswater, 1909.—357 paces north of railway station, at a point from which station house is just visible past east end of freight house; 158 paces distant from second and 136 paces from fourth telegraph pole west of station house.

J. C. B. No. 48, 1909.—To left of road from Rahman's Drift to Warmbad, via Norakhab, about three-fourths kilometer south of kilometer stone No. 21 from Rahman's Drift.

J. C. B. No. 83, 1909.—50 paces to left of road from Gibeon and 900 paces on Gibeon side of kilometer stone marked "Gibeon 104 km., Kuis 4 km."

Kalkfeld, 1909.—In a meadow about 250 paces from station house, the most northerly pillar of which is in true bearing 68° 17′.

Karibib, 1909.—On rising ground south of railway station, near schoolhouse and lazaret, 143 yards (131 meters) from schoolhouse and 113 yards (103 meters) from a new building belonging to the lazaret. A pole on top of beacon on signaling station east of school is in true bearing 249° 50′.

Keetmanshoop, 1909.—400 paces to left of railway from Seeheim, measured from a point 400 paces from end of stone railway station on side farthest from Seeheim.

Khamis, 1909.—On the road along the Hom River from Warmbad to Naochabeb, three-fourths kilometer on Dreihuk side of kilometer stone marked 27 kilometers from Dreihuk. This stone is at junction of road from Warmbad via Kalkfontein and road along Hom River.

Khan Copper Mine, 1909.—295 yards (270 meters) north of manager's house and close to west boundary of old river bed in which mine is located; this old river bed is now a sand slope, about 80 yards (73 meters) wide, with perfectly bare rugged sides.

Kilometer 233, 1909.—On line from Karibib to Windhoek, on a forest wheel road, south of railway and 216 yards (198 meters) from ganger's veranda.

AFRICA.

GERMAN SOUTHWEST AFRICA—*continued.*

Kilometer 275, 1909.—North of railway and 178 yards (163 meters) northwest from railway station; flagstaff on railway station is in true bearing 319° 46′.5.

Korab, 1909.—About 100 yards (91 meters) to right of railway to Tsumeb; the pole supporting veranda of railway station house is about 94° west of true south and distant 118 yards (108 meters).

Kubas, 1909.—54° west of south from railway station house and distant 342 yards (313 meters).

Kuibis, 1909.—To right of railway, 250 paces from main track and 150 paces from dead-end of north sidetrack.

Kumnabis River, 1909.—100 paces to right of road to Gibeon and 50 paces north of river.

Kye Karp River, 1909.—To right of high road from Keetmanshoop to Gibeon, in middle of vlei nearest drift, on Fahlgras side of river and near a large stone standing alone on bank.

Nabitsaus, 1909.—44 paces west of road from Rehoboth to Windhoek, 150 paces towards Windhoek from kilometer stone No. 46 from Rehoboth.

Okahandja, 1909.—West of railway and 259 yards (237 meters) from railway station house. Middle of large front window of station house is in true bearing 225° 41′.5, and west finial on west gable of magistracy, 320° 33′.4.

Okaputa, 1909.—South of some native huts on south side of railway and about 110 yards (100 meters) from station house. The following approximate true bearings were determined: station house, front north corner, 150° 49′; engine shed, corner nearest track and station house, 191° 15′.

Omaruru, 1909.—West of railroad, 231 yards (211 meters) from southwest corner of station house. The following true bearings were determined: center of top of water tank, 343° 19′.2; southwest corner of station house, 294° 41′.7; northeast corner of engine shed, 264° 06′.5.

Otavi, 1909.—About 265 yards (242 meters) east of station house; the northeast corner of hotel is in true bearing 17° 51′; the northwest corner of station house, 70° 35′; and south corner of water tank, 95° 44′.

Otjihavers, 1909.—East of railroad and 262 yards (240 meters) from southeast corner of station house, which is in true bearing 44° 42′.9.

Otjiwarongo, 1909.—South of railway, at a point from which station house bears 235° 16′ west of true south, and distant 260 yards (238 meters); back west corner of soldiers' house is in true bearing 304° 54′, and distant 91 yards (33 meters).

Rehoboth, 1909.—East of road from Gibeon, about 120 paces south of a pool and garden and on opposite side of road from a church.

Richthofen, 1909.—354 paces about true north from railway station.

Rotkuppe, 1909.—To north of railway from Aus, 365 paces from telegraph pole No. 541, and in range between pole and highest point of kopje.

Sandverhaar, 1909.—On opposite side of railway from station-master's house and 250 paces from the end of house nearer Seeheim, on a line perpendicular to the railway.

Seeheim, 1909.—On left or east bank of Fish River, 202 paces upstream from a point located 165 paces east of end of railway bridge.

AFRICA.

GERMAN SOUTHWEST AFRICA—*concluded.*

Sendlingsgrab, 1909.—To right of road from Gibeon to Rehoboth, 93 paces west from a river running north and south and 190 paces south from a river running east and west.

Sesskameelboom, 1909.—East of road to Rehoboth, in range with south wall of the dam, 50 paces from end of wall nearest road and about 300 paces northeast of De Wet's store.

Shakals Kuppe, 1909.—In range with Kuibis end of station house, 220 paces north of track.

Spitzkop, 1909.—To right of road from Keetmanshoop, in range with summit of Spitzkop and the well at its base, and about 50 paces to right of line from police station through well.

Swakopmund, 1909.—Southwest of distillery, nearly in line of Moltke Strasse, and exactly in the line joining Hohenzollern Hotel and second window of back shed of pumping station. The following approximate true bearings were determined: front line of Hohenzollern Hotel, 172° 10′; Behnke's Brennerei (top of vane), 134° 00′; finial over bow window of pump house, 346° 42′.

Trekkopje, 1909.—217 yards (198 meters) southeast of front east corner of station house, which is in true bearing 100° 21′.7; the fourth telegraph pole from station house is in true bearing 158° 10′.5.

Tsawisis, 1909.—180 paces south of a hillock which lies 114 paces due east of well.

Tschaukaib, 1909.—250 paces to left of railway from Aus, at a point about 80 paces from water tank.

Tsumeb, 1909.—West of railway tracks and of a grassy quadrangle 224 yards (205 meters) along a winding cartway south of office of Damara Mining Company, 6 yards (5 meters) west of cart track and 2 yards (2 meters) west of a tree. Northeast edge of Boesch Hotel bears approximately 7° 30′ west of true north and is 198 yards (181 meters) distant; the vane on Otavi Mining Company's office is in true bearing 226° 38′.5.

Tsumis, 1909.—East of road from Gibeon to Rehoboth, north of river, in line with stone trough on the nearer and a windmill on the farther bank; 108 paces from river bank where the drift comes out between two large kameelbooms and 90 paces from nearer of these two trees.

Usakos, 1909.—This point is the headquarters of the Otavi Eisenbahn and is on the edge of the desert. The station is west of railroad, 208 yards (190 meters) north of fence of police station and 445 yards (407 meters) north of door of railway director's house. The following true bearings were determined: flagstaff on turret of director's house, 354° 39′.9; finial of small choir behind church east of town, 251° 37′.1.

Usib Poort, 1909.—50 paces to right of short road from Rehoboth to Windhoek and 288 paces along road from a signpost marked "Usib 13 km., Rehoboth 28 km."

Windhoek, 1909.—On east side of road which runs along ridge west of main part of town; 5 yards (5 meters) east of road and 233 yards (213 meters) north from steps of north veranda of Elizabethheim. The following true bearings were determined: west edge of west pillar of north veranda of Elizabethheim, 340° 12′.7; steeple of Governor's house, 282° 21′.5; west finial of barracks near station, 228° 34.′7.

AFRICA.

PORTUGUESE EAST AFRICA.

Chinde, 1909.—In the "Extra Concession," 25 yards (23 meters) south of road which runs along northeast boundary of the British Concession and continues straight alongside the "Extra Concession" to golf shelter at sea beach; the station is opposite a point on this road 346 yards (316 meters) from the high east customs' fence of the British Concession.

Mapia, 1909.—About 1 mile (1.6 kilometers) south of Mapia Plantation pumping and loading station on a bare patch on left bank of river.

Morambala Mountain, 1909.—Two miles (3 kilometers) south of Filibakash, the head of navigation at low water, on east bank of river. The Morambala Mountain terminates here, on west side of river, in a granite boss.

Mozambique, 1909.—Near beach south of grassy yard at Fort Sebastian, 213 yards (195 meters) from southwest corner of fort and 180 yards (165 meters) from a house in western part of the yard.

Ntowa, 1909.—On the northeast shore of Zambesi River and close to bank north of village.

TRIPOLI.

Tripoli, Tripoli, 1905.—In a garden of palm trees belonging to the Girls' Italian Orphanage, situated 1 mile (1 kilometer) outside of city, between the negro village *Dhara* and the tombs, so called, of the Sultan's *Karamanli*. The steeple of the church of the Franciscan Mission in Tripoli is in true bearing 104° 47′.7.

UGANDA.

Bugubune, 1909.—To right of road which follows telegraph line, on Nimule side of native village.

Butiaba Port, 1909.—Between chief engineer's house and clerk's house, south of the booking office and southwest of a flagstaff.

Entebbe, 1909.—On Nsamuzi Hill, 20 paces west of brass mark where Delme Redcliffe determined latitude and longitude.

Gondokoro, 1909.—About 10 paces from east bank of Nile and west of the guest house, which is south of the Boma and the collector's house.

Hoima, 1909.—Between tennis court and the guest house, being 20 yards (18 meters) from veranda on Kampala side of latter.

Kampala, 1909.—In grounds of the Dak Bungalow, in front of house and about 20 paces from main road.

Kikonda, 1909.—On camping ground reserved for Europeans, in corner towards Kampala and away from road.

Kiriba, 1909.—North of Kit River, about 150 paces from edge of water, across from the villages of Kiriba.

Kirifi, 1909.—On Gondokoro side of two big trees on camping ground reserved for Europeans.

Koba, 1909.—On the Boma square, approximately equidistant from the Boma, the post office, and the guard room.

Lukaya, 1909.—To right of road from Makoko to Entebbe, between two sets of shelters for carriers.

Masaka, 1909.—East of the residency and north of parade ground.

Nkanuna, 1909.—On side of camping ground for Europeans farthest from Kampala and 30 paces from the road.

AFRICA.

UGANDA—*concluded.*

Nimule, 1909.—On left of road going from the Boma at Nimule to Gondokoro; 120 yards (110 meters) measured towards Gondokoro from the guest house, which was formerly the residence of district commissioner of police.

Sambia, 1909.—In middle of road at highest point on Mtukula side of village, where shelters for carriers are placed.

Uma River, 1909.—Under north side of a big tree in European camp, which is north of river and west of road to Gondokoro.

Wadelai, 1909.—100 paces southeast of telegraph office.

ASIA

ASIATIC RUSSIA.

Aktjubinsk, Turgai, 1909.—On west side of hill east of town; about 100 feet (30 meters) from site of ancient fort on top of hill, 400 feet (122 meters) east of the church, 300 feet (91 meters) south of tower on fire station, and 50 yards (46 meters) from corner of log storehouse south of fire station. The following true bearings were determined: water tower south of railroad station, distant about one mile (1.6 kilometers), 59° 22′.9; belfry spire of the church near station, 82° 48′.4; staff on fire-house tower, 188° 16′.7; spire of mosque about one-half kilometer southeast, 323° 55′.3.

Andijan, Ferghana, 1909.—Near the Vaenaia Plassiat, where the barracks were formerly located, 1 verst (1 kilometer) east of railroad station and on southeast edge of town. The place is best reached by driving from the railroad station up the main street to the church, then turning to the right into the street called Setchgievskaia, which runs directly to the station site. The main station is 40 feet (12 meters) west-southwest of some low mud ruins and 18 paces from stream of water flowing along south side of road leading out toward the present barracks. A secondary station was established 156 feet (48 meters) 69° 23′.2 west of south of main station and 10 paces from stream along south side of road to the barracks.

Aschur-Adé, Caspian Sea, 1909.—On a small island in the shallow waters of the southeast Caspian Sea, off the coast of Astrabad, Persia. The island is occupied by a settlement of about a dozen houses, a church, hospital, bakery, and water distillery. Station A is on flat open space between old church and new water distillery, about 500 feet (152 meters) from each.

Station B is 31 paces from Station A, on line extended from the right-hand corner of bath-house. The chimney on bakery bears 12°.6 west of south, cross on church spire 154° 00′, right-hand corner of bath-house 336° 38′.7.

Askabad, Transcaspian Territory, 1909.—On rising ground southwest of town, at a point where prolongation of the street Ulitsa Adistanskaia running west from the monument in the square Skobelenskoi Plassiat, near the military church, would intersect the prolongation of the street Ulitsa Krasnovodskaia; south of a large irrigation stream lined with trees and about 75 yards (69 meters) southwest of a telegraph line. The following true bearings were determined: right-hand and lower spire on dome of Church of the Resurrection, distant about one-half mile (0.8 kilometer), 211° 13′.5; left-hand and higher cross on military church, distant about three-fourths mile (1.2 kilometers), 281° 26′.2.

ASIA.

ASIATIC RUSSIA—*continued.*

Bukhara (Kagan), Bukhara, 1909.—At Kagan on the main line of the railroad, about 8 miles northeast of the old city of Bukhara; in an open field on edge of town near Russian Consulate or Agency, and about half a mile (0.8 kilometer) southeast of railroad station, in line with street called Boulevard Baron Vrevskago. The nearest corner of brick wall surrounding property of Russian Consulate is 128 feet (39.0 meters) distant and bears 161° 10′. A secondary station was established 112 feet (34.1 meters) 44° 57′.5 east of south from main station.

Charjui, Bukhara, 1909.—On open plain between town and river. Station A is about 500 feet (152 meters) north-northwest of road leading from town to steamboat wharves; about one-fourth mile (0.4 kilometer) east-northeast of barracks; about one-fourth mile (0.4 kilometer) west from steamboat landing, and about 1¼ miles (2.0 kilometers) south-southeast of west end of railroad bridge. The following true bearings were determined: black iron chimney, about 1 kilometer distant, 110° 59′.0; sentry box at west end of bridge, 144° 48′; sentry box at east end of bridge, 166° 28′.

Station B was established 155 feet (47.2 meters) 69° 01′.0 west of north of station A.

Chelkar, Turgai, 1909.—On plain between town and pond, about three-quarters of a kilometer west of church and about half a kilometer south of railroad; about 200 paces from edge of pond. The following true bearings were determined: water tower, 273° 23′.7; belfry spire of church, 271° 05′.6; spire on railroad station, 264° 09′.0.

Chimkent, Syr-daria, 1909.—On east side of Russian portion of town, about 1 verst (1 kilometer) northeast of post station, on a flat grass plot on north side of a pond and swamp; 50 feet (15 meters) south of line of tall poplars, about 150 feet (46 meters) from street west of grass plot and about 100 feet (30 meters) from pond. A signal post about one-half mile (0.8 kilometer) distant bears 321° 53′.1.

Dushak, Transcaspian Territory, 1909.—West of the village, about one-third mile (0.5 kilometer) southwest of railroad station, in a flat open plain used for grazing caravans, south-southwest of railroad shops; 426 feet (129.8 meters) from nearest railroad track. The following true bearings were determined: tall signal post near railroad track, distant about 1 kilometer, 81° 21′.6; east oil tank of two on north side of track, 155° 19′; water tower south of railroad shops and track, 230° 13′.

Emba, Ural, 1909.—About 300 meters southwest of railroad station, on edge of what appears to be bed of an ancient river, 125 meters west of railroad tracks and about same distance south-southeast of nearest house in village. The following true bearings were determined: water tower north of railroad station, 192° 40′.1; left-hand oil tank east of railroad tracks, 282° 33′.5; spire on west end of engine house, 301° 08′.3.

Kazalinsk, Syr-daria, 1909.—About 350 feet (107 meters) from southeast corner of wall around the commandant's house and 50 feet (15 meters) from edge of river bank; probably very near station of 1906 by Smirnov.

Khojend, Samarkand, 1909.—In open space near northeast corner of fort, probably a little north of position occupied by Schwartz in 1886; 50 paces from river bank, about 250 feet (76 meters) from street in front of church and post office, and 22 paces north of a lone tree near northeast corner of fort. A secondary station was established 119 feet (36.3 meters) 12° 24′.2 east of south from main station and 58 feet (17.7 meters) east of base of fort.

Kizil Arvat, Transcaspian Territory, 1909.—In the plain on south side of town, about a kilometer south of the Russian Church and nearly a mile (1.6 kilometers) from railroad station. The station is best reached by following the street which runs south just east of the church. On coming to the open plain two small ruins of mud walls will be seen about 100 meters apart. The main station is 69 feet (21.0 meters) west of the south ruin and about 100 yards (91 meters) west-southwest of the road to Kara Kalek, a village on the frontier. The spire of a church in town bears 176° 31′.2. A secondary station was established 38 feet (11.6 meters) east-southeast of north ruin, 332 feet (101.2 meters) from main station on line to church spire.

Kokand, Ferghana, 1909.—In open space about one-fourth mile (0.4 kilometer) southwest of railroad station and adjoining railroad station yard; about 500 feet (152 meters) from nearest railroad track, 55 feet (17 meters) from a wooden fence forming southwest boundary of field, and about 50 yards (46 meters) from roadway on south side of field. Observations were made at a secondary station 144 feet (44 meters) 57° 25′.1 east of north of main station.

Krasnovodsk, Transcaspian Territory, 1909.—In large open space north of church and northwestward of railroad station and approximately the spot occupied by Smirnov in 1906; nearly opposite entrance to broad Petroff Street, running northeast to mountains; about 125 feet (38 meters) from south corner of wooden fence to north; about 300 feet (91 meters) from northeast corner of fence around school building to southwest, and about 500 feet (152 meters) from nearest corner of church south-southeast of station. The staff on the railroad station about one-fourth mile (0.4 kilometer) distant bears 328° 11′.4. A secondary station was established 110 feet (33.5 meters) 12°.1 west of south from main station.

Merv, Transcaspian Territory, 1909.—In large open space about 300 yards (275 meters) by 600 yards (550 meters), near church in northeast part of town, about three-fourths mile (1.2 kilometers) east-northeast of railroad station. The main station is near western edge of space, about 500 feet (152 meters) from new church and about the same distance from old church, 24 paces from edge of street to west-southwest, and 48 feet (14.6 meters) from a plane tree to southwest. A line from this tree to right-hand corner of new church passes through the station. The following true bearings were determined: spire of new church, 219° 23′; spire on old church, 164° 31′.

A secondary station was established 207 feet (63.1 meters) 59° 33′.8 east of true north of main station.

Perovsk, Syr-daria, 1909.—About one-fourth mile (0.4 kilometer) due south of railroad station; 30 feet (9 meters) east of three small trees, 400 feet (122 meters) east of road where it turns toward railroad station, and about 40 paces northeast of corner of brick wall. The right-hand chimney or ventilator on water tower west of railroad station bears 167° 27′.0.

Samarkand, Samarkand, 1909.—On grounds of government silk station, about half a kilometer west of fort, lying between the ancient city and the Russian portion of town; this is same general location as Schwartz's station of 1886. The main station is in path running east-southeast through mulberry bushes, 100 feet (30.5

ASIA.

ASIATIC RUSSIA—*concluded.*

Samarkand, Samarkand, 1909—*continued.*
meters) from south wall and 175 feet (53.3 meters) from east wall. A secondary station was established at a point 284 feet (86.6 meters) 67° 37′ west of north of main station, in same path as main station, a few yards east of an irrigation stream which crosses the path, and 30 feet (9.1 meters) north of corner of mud wall about an inclosure, which was found to contain considerable iron. The latter is evidently the cause of the apparently anomalous values at this secondary station. Station No. 3 is in an open space about 500 feet (152 meters) north of silk station, approximately 400 feet (122 meters) from mud wall surrounding silk station grounds, about 30 paces west-northwest of an irrigation ditch lined with tall trees, just south of a second ditch running west-northwest from first, and about 45 paces from a line of trees which form the west boundary of the opening.

Tashkent Observatory, Syr-daria, 1909.—On a wooden pier in the absolute house, a non-magnetic wooden hut in northern part of the garden. During the simultaneous observations the instrument was mounted in line with white cross painted on black ground on astronomical observatory and pier in absolute house, at a point 117 feet (35.7 meters) south of latter.

Turkestan, Syr-daria, 1909.—Toward northeast side of town, in an open field on southeast side of road to artesian well (in construction); 80 yards (73 meters) from road and about 100 yards (91 meters) from southeast corner of a mud wall to northeast.

CHINA.

Akrabulak, Sinkiang, 1909.—In a river bed, dry during the dry season, in a small level mountain defile about 150 yards (137 meters) wide and surrounded by very high, almost perpendicular peaks of black shale; 37 yards (34 meters) west from main door of inn. The inn and a temple are the only buildings here.

Akshua, Sinkiang, 1909.—This is the name given to a group of houses in a valley about 20 miles (32 kilometers) south of Kilian, on the main route over the Himalaya Mountains. The station is about 50 yards (46 meters) east of first mud house on east bank of river as one goes up stream, at a point about a mile (2 kilometers) above the point where two small streams unite to form the Kilian River.

Aksu, Sinkiang, 1909.—In northeast corner of walled city of New Aksu, in large open space between military magistrate's yamen and east wall of city and now used for parade ground and rifle range; 99 feet (30.2 meters) from west wall of compound, 141 feet 10 inches (43.23 meters) from south wall, 143 feet 5 inches (43.71 meters) from northwest corner of a mud room along south wall, 141 feet (43.0 meters) from large poplar tree near corner of mud room, and about 235 feet (72 meters) from city wall on east; marked by hardwood tent peg driven flush with ground. The following true bearings were determined: west edge of roof of central yamen building, 115° 13′.5; projection on farthest corner of roof on east side of yamen, 152° 21′.9.

Amoy, Fukien, 1906.—On Kulangsen Island, the foreign concession, in yard of residence of British consul; near southwest corner of property near short flight of granite steps leading down hillside, 109 feet (33.2 meters) from south corner of residence, 15.2 feet (4.64 meters) from a tree to southeast near steps, and 9.5 feet (2.90 meters) from large square concrete pillar near steps; marked by a granite cylinder 18 inches

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CHINA—*continued.*

Amoy, Fukien, 1906—*continued.*
(45 cm.) in diameter, projecting 8 inches (20 cm.) above the general surface, the precise point being marked by the center of a cross cut in its top. The following true bearings were determined: east corner of consul's residence, 194° 23′.0; west corner of consul's residence, 152° 34′.9.

Ansichow, Kansu, 1909.—In an old unused yamen on principal street of city, about 100 yards (91 meters) east of center tower of city, 20 feet 2 inches (6.15 meters) from mud wall on west, 25 feet 2 inches (7.67 meters) from mud wall on north, 16 feet 10 inches (5.13 meters) from mud wall on east, and 21 feet 11 inches (6.68 meters) from wall on south; marked by 2 bricks 14 by 8 by 2 inches (36 by 20 by 5 cm.) set flush with ground.

An Tau, Fukien, 1906.—About 2 miles (3 kilometers) north of An Tau proper on the road to Foochow, within grounds of Home and School for Untainted Children of Lepers, which is under control of the Methodist Mission; near south corner of compound, being 70.8 feet (21.58 meters) from wall on southeast, about 46 feet (14 meters) from wall on southwest, and 60 feet (18.3 meters) from nearest corner of school building; marked by a lightly cut cross in a granite block 4 by 6 inches (10 by 15 cm.) sunk flush with ground. The tip of a prominent pagoda on a slight rise about 1.6 kilometers distant is in true bearing 281° 55′.9.

Bonham Island, Chusan Archipelago, Chekiang, 1906.—Approximately halfway between highest point of island and lighthouse, the latter being approximately 1200 feet (366 meters) distant to north-northeast; marked by a cross cut in a large stone sunk flush with the ground, over top of which a conical pile of stones about 30 inches (75 cm.) high has been erected and painted white. Base of vane on lighthouse tower is in true bearing 30° 14′.2.

Bulungir, Kansu, 1909.—On western edge of village, in center of inn-yard on south side of the only street.

Camp Makeshift, 1909.—At junction of two small streams which unite to form the Sanju River.

Canton, Kwangtung, 1906, 1907, 1908.—On grounds of the Canton Christian College at Honglok, on Honan Island south of Pearl River and about 3 miles (5 kilometers) from Canton City; on top of grave hill, elevated about 55 feet (17 meters) above high water and east of the main college buildings. Station No. 1, used prior to June 1906, is 32 paces due south from brow of hill on the north, and 24 paces east of a path which lies along the western point of the plateau. The tip of Flowery Pagoda in Canton City is in true bearing 128° 31′.0.

Station No. 2, used in 1906 and 1907, is about 50 paces due south from No. 1 and near the southern boundary line of a rectangular and level plat owned by the Canton Christian College; 20.75 feet (6.32 meters) and 28.42 feet (8.66 meters) from southwest corner of granite boundary stone to west, and from southeast corner of granite boundary stone to east, respectively.

Station No. 3, used in 1908, is 21.04 feet (6.41 meters) east of northeast corner of boundary stone No. 017 of the college property, 37.42 feet (11.41 meters) southeast of northeast corner of boundary stone No. 016, and 62.75 feet (19.13 meters) southwest of corner of boundary stone No. 015; marked by copper tack in teakwood peg driven flush with ground, and is in line No. 2 to Flowery Pagoda. The following true bearings were determined: Flowery Pagoda, 128° 59′.2; southeast corner of East Hall, 54° 04′.6.

ASIA.

CHINA—*continued.*

Canton, Kwangtung, 1906, 1907, 1908—*continued.*
Station No. 4, used in 1908, is in line with stations No. 2 and No. 3 and the Flowery Pagoda, 68.83 feet (20.98 meters) east of No. 3, 14.08 feet (4.29 meters) from northeast corner of boundary stone No. 034, 20 feet 8 inches (6.30 meters) southeast from southwest corner of boundary stone No. 036; marked by tent peg.

Cape Kami, Kwangtung, 1906.—On top of a sandy mound on an island lying between lighthouse and mainland at southern extremity of Lei Chau peninsula, 65 paces northward from high-water beach mark and about 2000 feet (610 meters) from lighthouse; marked by small wooden peg, covered with flat black stones, piled in the form of a cone about 18 inches (46 cm.) high. The vane on the lighthouse tower is in true bearing 58° 47′.7.

Changsha, Hunan, 1907.—In western part of yard at the residence of the commissioner of customs on an island in the river and west of Changsha; on southern border of path leading to back gate, near its west end just where the sharp decline to gate begins, 42 paces due west from west wall of veranda of the commissioner's house; marked by a granite pillar 3 inches (8 cm.) square on top, sunk flush with ground and bearing a cross cut in top face to mark exact spot. The following true bearings were determined: vertical axis of ornament at tip of josshouse roof across the river at south end of settlement called "The Ferry," 137° 02′.5; extreme right edge of veranda on commissioner's house at level of first floor, 298° 27′.6.

Changte Ho, Honan, 1907.—On a burial ground marked by a prominent grove of about sixty cedar trees and surrounded by cultivated fields, northeast of compound of Canadian Presbyterian Mission; marked by center of the bottom of a rough conical cavity, about 1¼ inches (4 cm.) in diameter at top, cut in top of one of four conglomerate boundary stones along the line of the most southern row of trees. This stone is third from east, and like other boundary stones is rounded off on top, about 6 inches (15 cm.) each way, and projects about 3 inches (8 cm.) above ground. The northwest edge of chimney turret on northwest corner of Mr. Griffith's residence is in true bearing 44° 45′.2.

Chaochowfu, Kwangtung, 1906.—On east side of Han River, opposite the city proper; on first rise back of the Baptist Mission residence and 300 feet (91.4 meters) from northeast corner of compound wall which bears true south 51° 52′ west.

Charkee, Sinkiang, 1909.—In northwest corner of official inn of the village, within a small inclosure surrounded by mud walls; 11 feet (3.4 meters) from west wall, 30 feet (9.1 meters) from north wall, and 24 feet (7.3 meters) from east wall. The following true bearings were determined: northeast corner of gate at entrance to inn, 344° 20′.4; southwest corner of the gate, 350° 21′.8.

Chefoo, Shantung, 1907.—On playgrounds of the Boys' School (for foreign children) of China Inland Mission; 91 feet (27.7 meters) from stone wall bounding the grounds on the north, measured from a point nearly opposite the gateway to the residence on north side of road and 49 paces from northwest corner of playgrounds; marked by the center of a rough cross cut in top of a gray brick, which is buried with its long axis horizontal, the top face being about 4 inches (10 cm.) underground. The vertical axis of weather vane over entrance to school building is in true bearing 301° 11′.2.

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Chengchang, Kansu, 1909.—In center of yard of first inn on left as village is entered from the south.

Chengchow, Honan, 1907, 1909.—Directly over southeast corner of a rectangular burial tract which lies nearly south of one of the residences of the Southern Baptist Mission, now occupied by Rev. Dr. Herring. This burial plot is 92 paces long from north to south and 32 paces wide; the northwest corner of tract is 47 paces from south wall of compound surrounding Mr. Herring's residence. The station is marked by a cross cut in top of stone which marks the boundary of southeast corner of burial plot. This stone is a rectangular shaft 6 by 7 inches (15 by 18 cm.) half rounded on top and projects out of ground 13 inches (33 cm.). The following true bearings were determined: west edge of front of Mr. Herring's residence at level of second floor, 167° 04′.1; eastern edge of chimney on south face of Rev. W. W. Lawton's residence, 209° 45′.5.

Chentow, Chihli, 1907.—The station is west of the railroad shops and offices and north of the village, also known as Chenkiachoang or Shihkiachwang, directly over the northeast corner of a rectangular burying-ground surrounded by cultivated fields; it is about 15 paces west and 139 paces north of intersection of two cart-roads near a wayside shrine, which in turn is about 335 paces from stone wall bounding railroad property on west, measured along a cart road which enters at third gate counting from southwest corner of that property. The small cemetery is 102 paces long in north and south line, 11 paces wide, and each corner is marked by a shaft of stone surmounted by a rounded cap; the center of a cross cut into the top of the stone marking northeast corner of cemetery is the exact spot. The following true bearings were determined: west side of recess of roadside shrine at base of arch, 354° 47′.9; tip of white ornament on front of residence of E. J. de Lapeyrière, inside railroad inclosure, 249° 20′.8.

Chergolochuan, Sinkiang, 1909.—In the official inn-yard of the village; about 10 paces from the south wall of yard and about 3 paces from road leading from the gate to guest room.

Chinchowfu, Shengking, 1907.—East of Chinchowfu on north bank of an ancient intrenchment and a little southeast from tomb of a Buddhist priest. This intrenchment intersects cart road to Ichow about 1,020 paces north of railroad to Newchwang, which crosses it over a stone culvert. The tomb stands near north bank of intrenchment, to right of cart road to Ichow, and the projection of its east edge upon bank is 49 paces northwestward from station. The station is marked by a wooden peg driven flush with ground. The tip of the city pagoda is in true bearing 44° 07′.0.

Chinkiang, Kiangsu, 1906, 1908.—Station A, reoccupied in 1908, is near the southwest corner of Victoria Park, or the foreign recreation grounds; at southwest corner of football field, 8.8 feet (2.68 meters) north of row of small trees and approximately 12 feet (4 meters) east of pathway; marked by block of limestone set with its upper surface about 5 inches (12 cm.) above ground and bearing on top a roughly cut cross which indicates exact point. The following true bearings were determined: tip on tower, west end of Boys' School building at Methodist Mission, 174° 51′.5; tip of flag pole at clubhouse, 172° 22′.7. Station B is the one occupied by M. Chevalier in 1897, in middle of small level plot on top of hill immediately south of Chinese settlement. It is not suitable for further occupation.

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Chol Koda, Sinkiang, 1909.—On level desert plain just east of most northeasterly of several inns which compose the village, 157 feet (47.8 meters) from northeast corner of inn and 174 feet (53.0 meters) from southeast corner.

Chuanchow, Fukien, 1906.—In the midst of the city proper on the playground of the English Presbyterian Mission school for boys. The exact spot may be located by projecting the south side of the small building, used as an elementary school, to the east 78 feet (23.8 meters) and thence measuring south 35 feet (10.7 meters); marked by a cross cut in top of a granite slab which is buried slightly below surface of ground. The tip of the cupola on the Mission school for boys is in true bearing 122° 07′.4.

Chui Chiu, Kansu, 1909.—In center of yard of most western inn on north side of main street. A cairn of rocks on hill is in true bearing 331° 27′.9.

Chumatien, Honan, 1907.—In cultivated field about 850 paces east of railroad, about in line with south wall of residence section of railroad-station compound and about 100 feet (30 meters) west of a prominent grove of 100 cedars surrounding two graves.

Chwanchensa, Sinkiang, 1909.—In the southwest corner of most westerly of five inn-yards composing village.

Dawanchin, Sinkiang, 1909.—Just outside old wall of village, at north end of main street running north and south; 10 paces east of abutment on east side of street and 15 paces north of village wall.

Erpatai, Sinkiang, 1909.—In the Turkoman inn across the street to south from Chinese official inn; about 30 feet (9 meters) from mud room along south side of inn and 40 feet (12 meters) from west wall.

Faizabad, Sinkiang, 1909.—In an open space in northeast corner of Chinese official inn; 12 paces from north wall, 20 paces from east wall, and 16 paces from south wall.

Foochow, Fukien, 1906.—Within the race course and recreation grounds in the foreign settlement, at a point on line joining track posts at northeast and northwest turns of track; 60 feet (18.3 meters) west of the center of a pathway measured from a point 87 feet (26.5 meters) south of south edge of small wooden bridge near north end of course; marked by a deeply cut cross in top of stone 6 by 6 inches (15 by 15 cm.) and sunk with its upper face somewhat beneath surface of ground. The tip of vane on flag pole at clubhouse is in true bearing 0° 03′.0.

Goma, Sinkiang, 1909.—In southeastern corner of garden called "Cardor Bagh," about one block north of main east and west street; 25.8 feet (7.86 meters) and 20.5 feet (6.25 meters) from mud walls to northeast and southeast respectively, and 64.4 feet (19.63 meters) and 53.0 feet (16.15 meters) to edges of open space to southwest and northwest.

Gutzlaff, Chusan Archipelago, Chekiang, 1906.—About halfway down the slope at western end of island; on a small nearly level shelf, approximately 350 feet (107 meters) from the light tower and just east and north of a clump of small trees.

Haimitszyi, Sinkiang, 1909.—In yard of only inn of village; 51.5 feet (15.70 meters) from mud room along south wall, 35 feet (10.7 meters) from edge of feed stables on west, and 57 feet (17.4 meters) from mud room on north. Not marked. The east corner of top of inn gate is in true bearing 40° 01′.5 east of south.

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Hami, Sinkiang, 1909.—In inn named Chang Sheng Lung, outside northwest gate of old walled city, on east side of great business street and about 500 feet (152 meters) north of northwest corner of city wall; 60 feet 1 inch (18.31 meters) from wall of mud rooms on west, 78 feet 5 inches (23.90 meters) from corner northwest, and 44 feet (13.4 meters) from wall of mud rooms on east.

Hanchwang, Shantung, 1908.—In open ground adjoining cultivated fields, about 300 yards (274 meters) northeast of canal lock and about 30 feet (9 meters) north of ridge running parallel to canal.

Hangchow, Chekiang, 1906.—In grounds of custom house at intersection of path which runs parallel to easterly side of custom house with the path which enters the gate to the commissioner's residence; 90.2 feet (27.49 meters) measured in a southerly direction along the path from a point on the line of the south side of the custom house produced 8 feet (2.4 meters) from the southeast corner; marked by a cross cut in top of a stone sunk nearly flush with ground. The northwest corner of central chimney on double residence of the indoor staff of customs is in true bearing 194° 09′.9.

Hankow, Hupeh, 1907.—In central field of new race course, which lies back of eastern end of the German Concession; near northwestern side of course and nearly in line between cupola on the clubhouse and half-mile post. Inner fence of trial track is 126 paces distant measured toward the half-mile post, which bears 44° 17′ west of true north. The station is marked by a cross cut in the top face of a red sandstone block, sunk deep in the ground; the top of the stone is 9½ by 7 inches (24 by 18 cm.). The tip of the cupola on clubhouse is in true bearing 328° 19′.2.

Hengchow, Hunan, 1907.—On the crest of the grave hill to northeast of grounds of American Presbyterian Mission and just back of the Fishermen's Temple.

Hiongpo, Kwangtung, 1906.—To left of entrance to inner harbor, on a bluff west of an old abandoned fort and just ashore from the anchorage of the steamer in outer harbor of Hiongpo, or Chappu Bay; in a small flat area, with burying grounds to west and north, a cultivated plot to east, cultivated plots and sea to south, 21 paces from first bank and 50 paces to rocks on shore line to southward, and 84 paces from the northeast corner of old fort; marked by an oak peg, driven flush with ground and covered with a pile of large stones.

Hoihow, Kwangtung, 1906.—At Hoihow Harbor light, about 6 miles (10 kilometers) west-southwest of Hoihow City; in a cultivated field, 33 paces south of line of north side of compound produced, and 90 paces east of east compound wall. The edge of the bluff lies about 90 paces to the north, the mean shore line of Hoihow Bay being about 690 yards (631 meters) distant. The following true bearings were determined: harbor obelisk, 257° 11′.8; flagstaff on custom house, 246° 10′.1; flagstaff on the British consulate, 249° 14′.0.

Holai-e-kuan, Sinkiang, 1909.—In the inner court of the Chinese official inn on main walk leading to center suite of rooms; 38 feet 5 inches (11.71 meters) from north wall, 34 feet 8 inches (10.57 meters) from east wall, 50 feet (15.2 meters) from south wall, and 38 feet 6 inches (11.73 meters) from west wall. The west edge of the spirit wall in front of entrance to inn is in true bearing 1° 52′.6.

Honanfu, Honan, 1909.—In extreme northwest corner of city wall, on edge of pit just inside a brick archway, 42.33 feet (12.90 meters) and 41.0 feet (12.50 meters)

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Honanfu, Honan, 1909—*continued.*
respectively from north and south inner edges of archway; marked by stone 4 by 6 by 15 inches (10 by 15 by 38 cm.) projecting about 4 inches (10 cm.) above ground and lettered C. I. 1909. The following true bearings were determined: spire on pagoda seen through archway, 306° 38′.4; center of memorial arch near station, 308° 30′.6.

Hongkong Observatory, Hongkong, 1906, 1907, and 1908.—Intercomparison work has been carried out here using the north and south observatory piers in the observing hut and an outside station to the south in line with piers. The latter is 47.0 feet (14.33 meters) from south pier and 55.38 feet (16.88 meters) from north pier. The observatory is on a hill nearly in the center of Kowloon, which is on mainland just across bay from Hongkong.

Hotzar, Sinkiang, 1909.—About 300 yards (274 meters) northeast of last inn in northwest corner of village; 22 feet (6.7 meters) north of a small stream and 10 feet (3.0 meters) and 17 feet (5.2 meters) from two willow trees, in a row of willows, to northwest and north respectively.

Howki Island, Miaotas Islands, Shantung, 1907.—On a knoll, 46 paces eastward from foot of zigzag stone wall along path from lighthouse; marked by a piece of flint rock, top surface of which is roughly rectangular, the intersection of a black cross, painted on top surface of stone on a background of white, marking exact point. A small pile of rocks has been placed over the stone.

Hua (Fachow), Kwangtung, 1907.—On point of land between concurrent streams east-northeast of city proper.

Hunlungtsz, Sinkiang, 1909.—In center of yard of most northeasterly of group of inns making up village; 63 feet 4 inches (19.30 meters) from wall of mud rooms on northwest, 33 feet 5 inches (10.19 meters) from corner of mud rooms on southwest, and 37 feet 3 inches (11.35 meters) from corner of mud rooms on northeast.

Hweining, Kansu, 1909.—In the large caravansary outside the west gate of the city on south side of road; about 200 yards (183 meters) from gate, 58 feet (17.7 meters) from south corner of a small mud room to right of door as one enters the caravansary, 48.5 feet (14.78 meters) from southeast wall, 43 feet 10 inches (13.36 meters) from northwest wall, 38.4 feet (11.70 meters) from east corner of room along west wall, and 72 feet 8 inches (22.15 meters) from north corner of a room along southeast wall. The east figure on top of tower at southwest corner of city wall is in true bearing 353° 51′.1.

Jentun, Sinkiang, 1909.—In center of yard of most northeasterly of group of inns making up village. The center cupola on yamen is in true bearing 19° 56′.9.

Kachek, Kwangtung, 1906.—On brow of hill to southeast of grounds of the American Presbyterian Mission, near a grave mound on top of a prominent knoll; 34 paces south of a path which passes along north side of mound in direction slightly north of east, 81 paces north of intersection of two paths forming the west angle of a triangular area and about 6 paces from center of the grave mound; marked by an oak peg driven flush with ground. The chimney on the mission house is in true bearing 80° 05′.7.

Kalakush, Sinkiang, 1909.—On the desert northeast of village, 70 feet 3 inches (21.41 meters) northeast of northeast corner of most easterly inn of village.

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Kanchow, Kansu, 1909.—In southwest corner of the city, in southwest corner of Catholic Mission compound; 84 feet 10 inches (25.86 meters) southwest of southwest corner of chapel, 7 feet 7 inches (2.31 meters) from west wall of compound, and 65 feet 2 inches (19.86 meters) from corner of compound to north; marked by cross in top of red sandstone post 4 by 6 by 24 inches (10 by 15 by 61 cm.) set in ground so as to project about 4 inches (10 cm.) and lettered C. I. 1909. The cross over second gateway of compound is in true bearing 190° 52′.2.

Kaotai, Kansu, 1909.—In a large inn-yard in southwest suburb of city, outside west gate; the inn is the second on left side of street as one enters the suburb. The station is 34 feet 6 inches (10.52 meters) from wall to south, 37 feet (11.3 meters) from wall west, and 50 feet (15.2 meters) from west edge of entrance.

Karashar, Sinkiang, 1909.—In playground of public school of Karashar, in old walled city of Karashar, near north gate and east of main road leading out of the gate; 29 feet 6 inches (8.99 meters) from north wall, 61 feet 7 inches (18.77 meters) from west wall, 131 feet 4 inches (40.03 meters) from northeast corner of nearest building, 14 feet (4.3 meters) from an irrigation ditch on the north, and 16 feet (4.9 meters) from an irrigation ditch on the east; marked by cross in top of porphyry granite post 24 inches (61 cm.) long with top dressed to 6 by 4 inches (15 by 10 cm.) and lettered C. I. 1909. The following true bearings were determined: northwest corner of school building, 23° 01′.8; northeast corner figure on roofed tower of east gate of city, 302° 10′.8.

Kargalik, Sinkiang, 1909.—In western part of city, in northwestern corner of the garden of Saet Bach. (The location was secured through the Amban of Kargalik and in seeking to relocate it the local official should be consulted.) It is 33 feet 2 inches (10.11 meters) from west wall, 26 feet 5 inches (8.05 meters) from north wall, and 23.5 feet (7.16 meters) from east wall. The point is marked by a wooden post 4 by 4 by 24 inches (10 by 10 by 61 cm.) projecting 4 inches (10 cm.) above ground and lettered on opposite sides C. I. and 1909.

Kashgar, Sinkiang, 1909.—In northeast corner of garden belonging to British Consulate and known as "Chini Bagh"; in intersection of walk along north side of garden and the last walk leading off at right angles to south, 8 feet (2.4 meters) from inside of mud railing to north, and 50 feet (15.2 meters) from east wall of garden; marked by cross in top of a conglomerate stone set flush with ground; this stone is one foot (30 cm.) square at the base, rounded off on top, and marked C. I. 1909 with paint. The following true bearings were determined: northeast corner of British Consulate, 80° 08′.7; cross on Father Hendricks' tomb, 165° 18′.6; northwest edge of mosque, 203° 59′.1; southeast porch pillar on mosque side of the Tumen river, 205° 26′.9.

Khotan, Sinkiang, 1909.—In the famous old garden belonging to Badrud Din Khan, Aksakal of British subjects in Khotan, on the main street of the Turki settlement, about three-fourths mile (1.2 kilometers) east of the Chinese walled city; in the northwest corner of the garden among some young fruit trees, 41 feet 5 inches (12.62 meters) from north wall, 56 feet 6 inches (17.22 meters) from west wall, 64 feet (19.5 meters) from center of walk to east of station, 8 feet 8 inches (2.64 meters), 10 feet 8 inches (3.25 meters), 9 feet 5 inches (2.87 meters), and 8 feet 11 inches (2.72 meters) from small trees northeast, northwest, southwest, and southeast respectively; marked by copper tack in top

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Khotan, Sinkiang, 1009—*continued.*
of wooden post, 8 by 8 by 30 inches (20 by 20 by 76 cm.), projecting 5 inches (13 cm.) out of ground and marked C. I. and 1909 on opposite sides. The following true bearings were determined: second pillar from south, 296° 37′.4; most southerly pillar along west side of summer house in garden, about 4 inches above ground, 298° 09′.2.

Kiukiang, Kiangsi, 1907.—In the cricket pitch in Victoria Park, which is the small public recreation ground just south of St. Paul's Cathedral in the foreign concession; 47.1 feet (14.36 meters) from inner face of brick wall on south side of park, 73.4 feet (22.37 meters) from southeast corner of concrete tennis court, and 81.2 feet (24.75 meters) from nearest corner of octagonal foundation of small pavilion to the north; marked by the intersection of a cross cut in top of an irregularly shaped stone, the greatest dimensions of which are 4½ by 8 inches (11 by 20 cm.) and which is set 3 inches (8 cm.) below the surface. The vertical diameter of the cross on spire of St. Paul's Cathedral is in true bearing 146° 02′.8.

Kochow, Kwangtung, 1907.—On the temple hill on west side of river, opposite the city; on the brow of the plateau, near a two-story pagoda, back of and up beyond the temple, near southwest corner of the plateau, 22 paces south of south wall of pagoda, and 6 paces west of the normal to middle point of south wall. The vertical diameter of top section of seven-story pagoda outside of north gate of city is in true bearing 254° 14′.8.

Koomish, Sinkiang, 1909.—In southwest corner of largest inn yard of village, a short distance south of spring which supplies the village with water; 24 paces from south wall, 18 paces from west wall, and 16 paces from east corner of mud room along west wall.

Korla, Sinkiang, 1909.—Just east of extreme northern end of Turki village, on level grassy sward surrounded on three sides by stream which separates it from village.

Kucha, Sinkiang, 1909.—In the yard of a Turki suburban home across river from and about half a mile (0.8 kilometer) east of city, near center of a rectangular mud platform about 50 feet (15 meters) long, 30 feet (9 meters) wide and 3 feet (1 meter) high. It is 22 feet 9 inches (6.93 meters) from the east corner, 23 feet (7.0 meters) from south corner, 28 feet 8 inches (8.74 meters) from west corner, and 28 feet 3 inches (8.61 meters) from north corner of platform; marked by hardwood tent peg. The southeast corner tower of the walled city of Kucha is in true bearing 73° 17′.0.

Kucheng, Sinkiang, 1909.—In entrance to the Choe-tai-shien district yamen, near south wall of city and about midway of city east and west; 45 feet (13.7 meters) from south wall, 50 feet 11 inches (15.52 meters) from south end of spirit wall on west, 61 feet 2 inches (18.64 meters) from north end of spirit wall, and 56 feet 8 inches (17.27 meters) from angle in wall southeast; marked by hardwood peg.

Kungtungtao, Shantung, 1907.—On Kungtungtao Island, about 5 miles (8 kilometers) north of Chefoo; on a sandy slope east and south of the lighthouse, about straight in from the sandy beach generally used when landing to visit the light, and at a point not far off line from French cemetery to light.

Kunsuwan, Kue Shan Islands, Chekiang, 1906.—On that part of the island known to foreign mariners as Observatory Hill. This hill is about 80 feet (26 meters) high and lies against the southeast side of island, from which it is cut off at high water. The station is at summit of hill and marked by a cross cut in a piece of conglomerate rock, about 8 inches (20 cm.) square, sunk flush with the general surface and painted white; a conical pile of stones about 30 inches (75 cm.) in height, also painted white, has been formed above station.

Kwan-chau-wan, Kwangtung, 1906.—On Governor's Island, on a slightly elevated sandy plateau in front of the governor's residence, about one-third of the way from west wall of governor's grounds to the shore, and north of road leading to gateway.

Kweilin, Kwangsi, 1907.—On land belonging to the Church Missionary Society, which is not far from north gate of city; on the tennis court, behind the residences, and between the residences and city wall.

Lanchowfu, Kansu, 1909.—In northeast corner of compound of Belgian Catholic Mission, outside east gate of city and south of east suburb wall; 42 feet 3 inches (12.88 meters) from east wall of compound, 37 feet (11.3 meters) from a small tree to northeast, and 58 feet 3 inches (17.75 meters) from north wall of compound; marked by 0.5 inch (1 cm.) drill hole in top of granite post 8 by 8 by 30 inches (20 by 20 by 76 cm.) projecting 3 inches (8 cm.) above ground and lettered C. I. 1909. A secondary station for determination of diurnal range of declination was established in garden of residence of Mr. Robert Coltman, 40 feet (12.2 meters) from east wall of garden and about 20 feet (6.1 meters) from south wall.

Leong Sui Bay, Kwangtung, 1906.—On point or peninsula lying along the harbor on south, on a level area at northern base of great hill on right as one enters harbor; 33 paces from the largest and most westerly group of rocks lying at northern end of land, and 4 paces south of path which crosses the peninsula from northeast to southwest; marked by oak peg driven flush with ground and covered with pile of stones.

Liangchowfu, Kansu, 1909.—At southeast corner of flat mud roof of house rented by the China Inland Mission and occupied by Mr. Preedy; 4 feet 7 inches (1.40 meters) from east wall of roof, 6 feet (1.8 meters) from raised portion of roof directly above main entrance, 20 feet 4 inches (6.20 meters) from nearest corner of roof to west, and 22 feet 9 inches (6.93 meters) from edge of a false chimney. The following true bearings were determined: tip of pagoda in northwest part of city, 121° 40′.5; tower on northeast corner of city wall, 229° 46′.3.

Liuchiao, Kiangsu, 1906.—On large alluvial island, called Tsung Ming, lying in the mouth of the Yangtse Kiang; on southern shore of island, at a point about 1,100 feet (335 meters) down river, southeastward from Liuchiao light tower and just behind and below dike surrounded by lands entirely used for cultivation. Base of vane on lighthouse tower is in true bearing 133° 05′.2.

Lungko, Sinkiang, 1909.—In southeast corner of official inn-yard in narrow space between mud rooms and east wall of inn; 14 feet 8 inches (4.47 meters) from east wall, 22 feet 11 inches (6.98 meters) and 18 feet 11 inches (5.77 meters) from northeast and southeast corners of north section of mud rooms. The large li pillar at northwest corner of inn is in true bearing 116° 31′.2.

Maralbashi, Sinkiang, 1909.—In grounds of the Chinese joss temple in the walled city near east gate and just west of the Maralbashi public schools, in center of

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Maralbashi, Sinkiang 1909—*continued.*
main walk and about halfway between entrance and temple; 52 feet 10 inches (16.10 meters) from northeast corner of building east of entrance, 52 feet 3 inches (15.93 meters) from northwest corner of building west of entrance, 69 feet 9 inches (21.26 meters) from southwest corner of temple building, and 70 feet 9 inches (21.56 meters) from southeast corner of temple building; marked by hardwood tent peg driven flush with ground. The southwest corner of temple building about 3 feet above ground is in true bearing 173° 04′.6.

Mokanshan, Chekiang, 1906.—In front of residence of Mr. C. Pape, near center of tennis court.

Muliho, Sinkiang, 1909.—In official inn-yard on hill at western edge of village.

Nanchang, Kiangsi, 1908.—On the grounds of the Methodist Mission, between three mission residences and river, and west of most southern of the residences; 13 paces from river wall, measured from a point 39 paces northwest of first angle; marked by cross cut in top of granite slab 11 by 3 inches (28 by 8 cm.) projecting about 7 inches (18 cm.) above ground. The southwest corner of the Charles residence is in true bearing 281° 28′.5.

Nanking, Kiangsu, 1907.—On playground of Nanking University, in main building line of south front of Fowler Memorial produced eastward 82 paces, 192 paces southeasterly from southwest corner of Cooper Hall, and nearly directly in front of the wall gate, south of Prof. Martin's residence; marked by intersection of deep cross cut in top surface of a stone sunk about 3 inches (8 cm.) beneath surface of ground. The following true bearings were determined: southwest corner of Cooper Hall (outer edge of water table), 112° 54′.1; southeast corner of vestibule Fowler Memorial (outer edge of water table), 89° 45′.9.

Newchwang, Shengking, 1907.—On the garden property of B. C. Carlos; 45 paces from boundary line of property on the east, 228 paces south of center of a roadway bounding property on north, 80 paces east and 75 paces north from intersection of south boundary of lot with the canal; marked by granite stone with cross cut in its top face to mark exact spot. The following true bearings were determined: cross on bell tower of St. Nicholas church, 94° 02′.3; tip of northeast turret on Catholic church tower, 117° 47′.6; customs flagpole, 125° 54′.3.

Ningpo, Chekiang, 1906.—On playgrounds of the English Methodist College; 110 paces west and 4 paces north from north side of back gate of school inclosure; marked by cross cut in face of triangular stone set flush with present surface but likely to be covered in leveling playground. The following true bearings were determined: rod on dome of Catholic school, 356° 52′.2; ornament over west gable, Gentry's school, 222° 17′.3; ornament over east gable, Gentry's school, 243° 43′.9; ornament over north gable, Methodist school, 285° 38′.3; ornament over south gable, Methodist school, 305° 32′.5.

Northeast Promontory, Shantung, 1907.—On small level patch in valley, just southwest from old bell tower standing about 1.5 miles (2 kilometers) west of lighthouse; 71 paces in a direction down the hill south 10° east from a point 86 paces west of southwest corner of bell tower, in a worn path; it is also about 114 paces southwest of southwest corner of bell tower. The tip of ornament on top of bell tower is in true bearing 218° 04′.4.

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CHINA—*continued.*

North Saddle, Chusan Archipelago, Chekiang, 1906.—On top of a small promontory upon which lighthouse stands, near northwestern extremity of island. This promontory is the small projection which separates larger inlet to south from a smaller one where light keepers maintain their landing. The station is in middle of a small level plateau on outward part of promontory, about midway between outer edge and junction with main body of island, and marked by cross cut in upper face of a granite block 6 by 7 inches (15 by 17 cm.) sunk flush with general surface and painted white. A conical pile of stones about 30 inches (75 cm.) high has been erected above station and is also painted white. The wind vane on top of light tower is in true bearing 207° 15′.9.

Peiyushan, Heishan Islands, Chekiang, 1906.—Among some small cultivated areas on east side of island, about one-third the way down slope toward village from ridge; on a small level patch just below a sudden fall of about 5 feet (1.5 meters) and to left of path leading down toward inlet and fishing village; marked by cross cut in the face of a stone sunk flush with ground and covered with a conical pile of stones about 30 inches (75 cm.) high and painted white. The ball on the flag pole of light tower is in true bearing 2° 48′.6.

Peking, Chihli, 1907, 1909.—In northeast corner of the Tartar City, near the Laura Temple, within the observatory grounds of the Russian Ecclesiastical Mission; 38.85 feet (11.84 meters) west of southwest corner of brick observing tower which carries sunshine bulb, measurement being taken to face of first projecting course below main portion of tower; marked by cross cut in top face of stone 4.5 inches (11.4 cm.) square. The following true bearings were determined: cross on tower over main gate on south side of Mission grounds, 13° 24′.4; south edge of southwest tower on Memorial Chapel in northwest corner of Mission grounds, 257° 45′.0.

Pialma, Sinkiang, 1909.—In a large garden called "Ba wo dun" on south side of road to Khotan and adjoining village on east; between first and second rows of grapevines south of fruit trees, 137 feet (41.8 meters) from west fence, 183 feet (55.8 meters) from east fence, and 17 feet (5.2 meters) from a low dike east of station; marked by tent peg driven flush with ground.

Pingfan, Kansu, 1909.—In a large private yard on opposite side of street from last inn on main road outside and west of west gate of the city; 29 feet (8.8 meters) from corner of feed stalls for animals to northeast.

Pingliang, Kansu, 1909.—In school grounds of the Scandinavian China Alliance Mission school for children of missionaries, near west gate of city; 22 feet 6 inches (6.86 meters) from east wall of compound, 69 feet (21.0 meters) from west wall, 48 feet 6 inches (14.78 meters) and 50 feet 7 inches (15.42 meters) from two small date trees to north-northeast and north respectively; marked by large stone 6 by 18 by 18 inches (15 by 46 by 46 cm.) set flush with ground and roughly lettered C. I. 1909. The following true bearings were determined: top of tower on city wall, 49° 59′.1; southwest corner of school building one foot above ground, 176° 48′.1.

Putu Island, Chusan Archipelago, Chekiang, 1906.—On a small plateau on southeastern slope and near summit of most southern of three small hills, about 500 feet (152 meters) in height, which are near center of island and just west of large bay on east side of island. From the station the summit of highest and central peak at north of Lakea Island, and inner corner of promontory which divides bay on east of Putu, appear in line.

ASIA.

CHINA—*continued.*

Putu Island, Chusan Archipelago, Chekiang, 1906—*cont.* The station is marked by cross cut in upper face of large stone sunk flush with general surface; over it has been placed a granite boulder about 16 inches (40 cm.) in diameter, and four wooden stakes have been driven near the four corners. The marking stone, granite boulder, and four stakes were painted white; on large boulder about 10 feet (3 meters) to north were painted the letters T. M. C. I. The tip of tower on Loka light, about 5 miles (8 kilometers) distant, is in true bearing 289° 23′.8.

Shandanshien, Kansu, 1909.—In the center of a large inn-yard outside west gate of east suburb of city. The inn is an unusually large one, about 200 feet (61 meters) long and over 100 feet (30 meters) wide, and is the second on left as one leaves city towards east. The northeast edge of chimney on west wall of yard is in true bearing 342° 00′.6.

Shanhaikwan, Chihli, 1907.—Near northwest corner of old wall of a destroyed village, a short distance south of point where railroad breaks through great wall, and rectangular in shape, the east side of rectangle being formed by great wall. Station is on a knoll used as burying ground, about 120 feet (36 meters) from north wall of old village and about in line with west wall. There are two deep gullies between knoll and north wall. Station is marked by cross cut in top of a blue-gray tombstone 15 by 11.5 by 6 inches (38 by 29 by 15 cm.) and bearing on its south face an inscription, the last character of which indicates that it is the grave of a woman. The tip of tower on southeast corner of city wall is in true bearing 148° 32′.8.

Shan-tao-ling, Sinkiang, 1909.—In the first inn on east side of main road as one enters the village from the south; 17 paces from wall northeast, 22 paces from wall southeast, 28 paces from wall southwest, and 23 paces from east corner of building to the west. Small projecting tip on lower edge of sloping roof of temple or theater is in true bearing 151° 46′.8.

Shaweishan Island, Kiangsu, 1906.—At western extremity of summit of island at mouth of Yangtse River at a point a few paces west and north of platform for the flag and signal gun (gun was removed about 250 feet (76 meters) during observations); approximately 500 feet (152 meters) west of lighthouse and marked by cross cut in upper face of stone block about 5 by 14 inches (13 by 36 cm.) sunk flush with general surface, and painted white. A conical pile of stones about 2 feet (0.6 meter) high, also whitened, was erected above station. The base of wind vane on lighthouse tower is in true bearing 258° 26′.0.

Shenchow, Honan, 1909.—In yard of a small temple about one-eighth mile (0.2 km.) south of southeast corner of city. The temple consists of two low tile-roofed buildings, inclosed by mud wall, and is the only building on plain in this direction from city. Station is 26.25 feet (8.00 meters) from southeast wall, 30.0 feet (9.1 meters) from southwest wall, and 22.5 feet (6.86 meters) from northwest wall; marked by cross cut in top of large boulder embedded in ground flush with surface and lettered C. I. 1909. The tower on the southeast corner of city wall is in true bearing 185° 24′.9.

Shin Chuanii, Kansu, 1909.—In the inn-yard nearest west gate of city, and inside city wall; between the pig-and-sheep pen and place where animals feed, 30 feet (9.1 meters) from mud wall on south, 8 feet (2.4 meters) from east wall, and 12 feet (3.7 meters) from north wall. The corner of parapet on south wall is in true bearing 21° 45′.0.

ASIA.

CHINA—*continued.*

Sianfu, Shensi, 1909.—In the Swedish Mission compound, just outside west gate of city, on school playground; 92.8 feet (28.29 meters) north of northwest corner of schoolhouse, 25 feet (7.6 meters) from mud wall on west side of compound, 40 feet (12.2 meters) from southeast corner of gatekeeper's house, and 36.5 feet (11.1 meters) from entrance at main gate; marked by hole in top of grayish black stone 4 by 7 by 36 inches (10 by 18 by 91 cm.) set flush with surface of ground and lettered C. I. 1909. The northeast corner of schoolhouse about a foot above ground is in true bearing 332° 39′.2.

Soochow, Kiangsu, 1906.—On grounds of the Soochow University of the Southern Methodist Mission, within city near southeast gate; south of main building, nearly in line with east side of steps. From the station the angle subtended by the building is 30° 00′.6, and the southwestern corner is distant 255.4 feet (77.84 meters). The station is marked by cross cut in top of granite block sunk slightly below general surface. The tip of clock tower is in true bearing 170° 08′.6.

Southeast Promontory, Shantung, 1907.—On elevated level ground, near eastern side of narrow part of promontory, just west of a footpath running northward along promontory ridge, and about 30 paces north of a point in path which is 24 paces east of its junction with paved walk leading to lighthouse compound; about 900 feet (274 meters) north of light tower, and marked by intersection of cross cut in top of an irregular stone projecting about 3 inches (8 cm.) above ground and covered with pile of large stones.

Suchow, Kansu, 1909.—On property belonging to the Roman Catholic Mission in northwest corner of city, in open space east and in front of entrance to mission compound; 134 feet 10 inches (41.10 meters) east from south pillar at entrance and 83 feet 8 inches (25.50 meters) from mud wall on north; marked by stone pillar 4 by 8 by 24 inches (10 by 20 by 61 cm.) set flush with ground with "C. I. 1909" painted in black on top. The following true bearings were determined: tip of temple, 268° 46′.8; tip of tower in center of city, 310° 30′.7; tip of near pagoda, 298° 06′.9.

An auxiliary station was established in yard of largest inn on south side of street in east suburb of city.

Swatow, Kwangtung, 1906.—Near water front on north bank of river, within and near eastern end of the English Presbyterian Mission compound. Exact spot of earlier observations by Doberck could not be identified. It is nearly in front of middle one of three large residences which stands some distance back of ones to right or left, 72 feet (21.9 meters) from center line of walk along front of the two last, 71.5 feet (21.79 meters) from a large tree nearly north and in direction of more easterly house, 27.4 feet (8.35 meters) from a corner stone somewhat west of south, and 12.0 feet (3.66 meters) from inside line of grassy mound along water front. The vertical diameter of gilded ball on flagstaff and signal pole at custom house is in true bearing 38° 24′.5.

Taierhchwang, Shantung, 1908.—In a cultivated field on south side of grand canal, 370 yards (338 meters) south of highest brink of south bank of canal, and just south of main road which parallels canal in rear of small settlement; in a path near its junction at right angles with a foot path which parallels canal just south of ridge or dike south of settlement, 668 paces north-northwest of northwest corner of outer wall of Whei Whei Tsz Monastery, and 233 paces south of northeast corner of main building of the San Kwan Mia Temple. The following true bearings were deter-

ASIA.

CHINA—*continued.*

Taierhchwang, Shantung, 1908—*continued.*
mined: northeast corner of main building of San Kwan Mia below eaves, 176° 36′.5; vertical diagonal of small rectangular piece below peak of roof on west end of smaller building of Whei Whei Tsz Monastery, 285° 36′.5.

Taiyuanfu, Shansi, 1907.—In a large tract of cultivated land just north of grounds of European Department of the Imperial University of Shansi; near eastern edge of field, which is bounded on that side by an irregular gully, 132 paces directly north from east side of gateway of the University on north side of grounds, and nearly in line between front wall of Imperial Temple on west and gable line of main building in Confucian Temple on east; marked by cross cut in top of granite slab 12 by 6 inches (30 by 15 cm.) planted deep in the earth and standing 9 inches (23 cm.) above ground. The following true bearings were determined: eastern gable of gate tower of south city gate, 38° 41′.1; tip of cupola at southwest corner of Baptist Mission doctor's residence, 145° 33′.6; outer edge of southwest corner of compound wall surrounding the Confucian Temple, 338° 22′.7.

Tashitu, Sinkiang, 1909.—On hillside south of group of inns composing village. It is the following distances from five pillars at village entrance: 44 feet (13.4 meters) from southeast corner of north pillar; 32 feet (9.8 meters) from southeast corner of second pillar; 27 feet (8.2 meters) from southwest corner of third or middle pillar; 37 feet (11.3 meters) from southwest corner of fourth pillar; 53 feet (16.2 meters) from fifth or south pillar. The point is over east edge of a black stone firmly embedded in ground.

Tientsin, Chihli, 1907.—At southwest corner of large tract of reclaimed land lying south of race-track grounds; near center of small rectangular projection of land which is at junction of the canals which bound reclaimed tract on south and west; marked by gray brick buried on end, projecting above surface about 2½ inches (6 cm.) and having on its top face a rough cross to mark exact center.

Tihuafu (Urumchi), Sinkiang, 1909.—In grounds of the Russian Consulate, at extreme southern edge of south suburb of city, in an open space north of road leading from main entrance of consulate to consul's house; 33 feet 4 inches (10.16 meters) from east side of grounds, 90 feet 4 inches (27.53 meters) from southeast corner of vice-consul's house, 50 feet 4 inches (15.34 meters) from north tree of a row of poplars to northwest, and 43 feet 7 inches (13.28 meters) from southeast corner of consul's house; marked by hardwood tent peg. The following true bearings were determined: southeast corner of chancellery, 15° 11′.5; southeast corner of consul's house, 64° 48′.2.

Tagiamanlak, Sinkiang, 1909.—At junction of two small streams which flow from northwest and south and unite to form Karakash River; about 30 yards (27 meters) east of right bank of small stream which flows from south and 300 yards (274 meters) south by west of two or three mud houses inhabited by Turki families.

Tsinan, Shantung, 1908.—In vacant lot in grounds of the Imperial University; west of western dormitory and north of residence of foreign staff, 106 feet (32.3 meters) from west wall and 151 feet 3 inches (46.10 meters) from north wall; marked by one-inch wooden peg driven flush with ground. The vertical diameter of pagoda on mountain top, 2 miles (3 kilometers) distant, is in true bearing 309° 54′.0.

ASIA.

CHINA—*continued.*

Tsingkiangpu, Kiangsu, 1908.—In yard of residence of the physician of the Presbyterian Mission, near northeast corner of tennis court; about 10 feet (3 meters) east and 15 feet (5 meters) south of sundial, about 90 feet (27 meters) north of north wall of dispensary, 27 feet (8.2 meters) east of mud brick wall, and 75 feet (22.9 meters) northwest of northwest corner of physician's residence.

Tsingtau, Shantung, 1908.—On magnetic pillar of German government observatory. The observatory mark—a staff on Iltis Hill—is in true bearing 282° 59′.3.

Tsining, Shantung, 1908.—On grounds of the American Presbyterian Mission in southeast suburb of city, about one-fourth mile (0.4 kilometer) from canal, in an oblong vacant lot behind residences of Messrs. Romig and Thompson; about 12 paces west of east wall and 60 paces south of north wall, in projection of north side of middle entrance in east wall.

Tszmechuan, Sinkiang, 1909.—In a large open space partially inclosed by mud wall, just west of and adjoining the Chinese official inn of village; this inn is the last building at western side of village. The station is 18 paces from west wall, 20 paces from north wall, and 35 paces from east wall, which is the west wall of the inn; marked by a tent peg.

Tukson, Sinkiang, 1909.—In southeast corner of village, in grounds of officers' quarters and soldiers' barracks; the grounds are inclosed by thick walls. It is 77 feet 11 inches (23.75 meters) north of entrance to official stables, 118 feet 6 inches (36.12 meters) from south wall of garden, and 99 feet 11 inches (30.45 meters) northeast of corner where stable wall turns; marked by hardwood peg projecting 2 inches (5 cm.) above ground. The peak on distant mountain seen through entrance to stable is in true bearing 16° 10′.2.

Tumschuk, Sinkiang, 1909.—In the shade of some trees bordering stagnant pool which furnishes water supply of village. A large and very conspicuous li pillar in center of village bears 143° 15′.0.

Tungkwan, Shensi, 1909.—In an inn-yard near west gate of city and at southeast corner of gate wall; 13.67 feet (4.17 meters) east of west wall, 35.5 feet (10.82 meters) south of north wall, 38.83 feet (11.84 meters) from northwest corner of wall, and 43.5 feet (13.26 meters) from center of wall; not marked. A low tower on hill about one mile distant is in true bearing 279° 51′.1.

Turfan, Sinkiang, 1909.—In driveway of an estate belonging to Tung Darin, about one-half mile (0.8 kilometer) north of north gate of Chinese city of Turfan; about 90 feet (27 meters) from main entrance to estate, 17 feet (5.2 meters) from east boundary, 50 feet 8 inches (15.44 meters) from northeast corner, 50 feet 6 inches (15.39 meters) from north boundary, and 44 feet 4 inches (13.51 meters) from nearest tree of a grove of three trees southwest; marked by stone post 4 by 6 by 24 inches (10 by 15 by 61 cm.) projecting about 3 inches (8 cm.) above ground and lettered C. I. 1909. The following true bearings were observed through entrance to estate: west edge of south gate tower, 14° 41′.2; center tower of Chinese city, 17° 24′.0.

Ushtalla, Sinkiang, 1909.—In barracks of Chinese garrison southwest of village; 100 yards (91 meters) from main street, 30½ feet (9.30 meters) from edge of gate to north, 29 feet 1 inch (8.86 meters) from edge of gate to northeast, 15 feet 5 inches (4.70 meters) from southeast wall, 63 feet 1 inch (19.23 meters) from southwest wall, and 29 feet 4 inches (8.94 meters) from northwest wall; marked by hardwood tent peg driven flush with ground.

ASIA.

CHINA—*continued.*

Weihsien, Shantung, 1908.—In compound of the American Presbyterian Mission in northwest section of grounds of Union Arts College of Shantung University; in center of lot between church and astronomical observatory, 136 feet 11 inches (41.73 meters) west-northwest of southwest corner of western entrance to church, and 43 feet 11½ inches (13.40 meters) from west wall of compound; marked by round wooden peg one inch in diameter driven flush with ground.

Woosung, Kiangsu, 1907.—Two main stations were established. Station 12 is on left bank of Woosung River, about 1 mile (1.6 kilometers) above harbor master's quarters and the tidal semaphore; about 4 feet (1.2 meters) above ordinary high water, about 34 feet (10.4 meters) from water's edge at high water, and 130 feet (40 meters) from earth embankment that extends along river; marked by a pine stake about 5½ inches (14 cm.) square and about 40 inches (about 102 cm.) long. The following true bearings were determined: station Woosung 13, 180° 08′.1; tidal semaphore, 128°25′.7.

Two auxiliary stations to 12 were occupied and designated as 12_M and 12_N, being 27 feet (8.2 meters) and 51 feet (15.5 meters) respectively from 12 in true azimuth line 131° 34′.9.

Station Woosung 13 is on right bank of Woosung River, almost due north across the river from station 12, and distant about one mile (1.6 kilometers); on a high grassy bank, which forms the north side of a small inlet, and is about 300 feet (91 meters) north of large sign which reads "Telegraph cables across the channel here"; marked by a large tent peg. The following true bearings were determined: the tidal semaphore, 65° 58′.6; upper limit anchorage beacon, 338° 43′.0.

Wuchow, Kwangsi, 1907.—On lawn of British consul's residence, on a high hill on western bank of the Fu River, where it joins West River. It is near outer or eastern edge of lawn in front of house. The tip of pagoda on south bank of West River is in true bearing 299° 12′.2.

Wuhu, Anhwei, 1907.—Just west of tennis court of hospital of the American Methodist Mission; between tennis court and river, 14 paces east of a boundary stone near river bank, and 29 paces west of a second boundary stone near southern corner of tennis court; marked by a stone 3.8 by 3.8 by 9 inches (9 by 9 by 23 cm.) projecting about 3 inches (8 cm.) above surface, and having a rough cross cut in its top to mark exact spot. West corner of west chimney on residence of Mr. Lund of the American Church Mission is in true bearing 316° 16′.3. Another point, designated as Wuhu B, near west post of tennis court, was also occupied.

Yaichow, Kwangtung, 1906.—At base of a sandy arm or spit projecting to southwest and dividing main harbor of Yaichow from bay on southeast; in an open space surrounded by bushes except toward water on east; near path which runs northwest from east side of spit, 30 paces from high-water mark on east, 4 paces southeast from center of a round grave mound, and 122 paces southeasterly from main cart road along western shore of spit; marked by round wooden stake driven flush with ground.

Yakakudk, Sinkiang, 1909.—In yard of official inn, 47 feet (14.3 meters) from east wall, 36 feet 7 inches (11.15 meters) from mud rooms south, and 28 feet 10 inches (8.79 meters) from southeast corner of mud rooms northwest.

ASIA.

CHINA—*continued.*

Yalinkan, Kwangtung, 1906.—On shore near southwestern corner of inner Bay of Yalinkan, almost due south from the white rock and staff on north shore, set there to mark channel leading into bay; 8 paces from low-water mark and 3 paces east of path from shore to undergrowth. Position occupied by the French survey, though not permanently marked, is probably very near. The station is marked by oak stake driven flush with ground. The center, near base, of staff marking line through channel is in true bearing 358° 46′.7.

Yangchow, Kiangsu, 1906.—In yard of Medical Mission of Southern Baptists; in border of garden path where it makes a turn around well, about 48 paces from line of east side of the residence measured along edge of path; marked by cross cut in upper face of a large piece of limestone, embedded in concrete, and sunk nearly flush with general surface. The following true bearings were determined: northeast corner of turret on city wall, 48° 31′.8; northwest corner of turret on city wall, 49° 01′.8.

Yangihissar, Sinkiang, 1909.—In field north of official inn, near a pit which has been dug for making brick, 16 paces from mud wall on north, 11 paces and 22 paces from irrigation ridges to east and west respectively.

Yang Kiang, Kwangtung, 1907.—In yard of the Presbyterian Mission, which is about one quarter mile (0.4 kilometer) east of east gate of city; about 50 feet (15 meters) west of east wall of compound, about 36 paces from south wall, and about 38 paces southeast of nearest corner of eastern residence; marked by square wooden peg driven flush with surface. The following true bearings were determined: tip of octagonal pagoda known as "East Pagoda," 256° 17′.6; tip of the conical pagoda known as the "South Pagoda," 345° 35′.6.

Yangsar, Sinkiang, 1909.—Near extreme western end of the one street of the village, in the official inn; 45.5 feet (13.87 meters) from north mud wall, 67 feet 2 inches (20.47 meters) and 59 feet (18.0 meters) from outer edges of mud rooms on east and south respectively, and 65 feet (19.8 meters) northeast of large mulberry tree.

Yarkand, Sinkiang, 1909.—In beautiful old garden called Kholococha, about one mile (1.6 kilometers) southeast of city; in southeast corner of garden, in small open space among trees, 53 feet 3 inches (16.23 meters) from wall to east, 77 feet 10 inches (23.72 meters) from wall to south, and 26 feet 4 inches (8.03 meters), 36 feet 11 inches (11.25 meters), and 23 feet 6 inches (7.16 meters) from trees to north, northwest, and south-southwest respectively; marked by wooden post 4 by 4 by 30 inches (10 by 10 by 76 cm.) projecting 4 inches (10 cm.) above ground and with letters C. I. 1909 cut on one side.

Yenche, Konsu, 1909.—In the large inn-yard of second inn from last on east side of street as village is entered from south; 36 feet 4 inches (11.07 meters) from southeast wall, 45 feet 1 inch (13.74 meters) from northeast wall, 42 feet (12.8 meters) from northwest wall, and 43 feet (13.1 meters) from corner of east side of entrance.

Yungchow, Hunan, 1907.—On open ground northeast of compound of the English Wesleyan Mission, at a point 37 paces east and 11 paces north of northeast corner of mission compound.

Zikawei, Kiangsu, 1906, 1907.—Two stations, designated as N and S, were occupied near magnetic hut used for absolute observations at the Zikawei observatory.

ASIA.

CHINA—*concluded.*

Zikawei, Kiangsu, 1906, 1907—*continued.*
Station N is 21.3 meters north 6° west of pier in hut, and station S is 16.7 meters south 11° west. Observations were also made in the magnetic hut used for absolute observations.

CYPRUS.

Larnaca, Island of Cyprus, 1910.—In the central part of a park owned by the municipal government of Larnaca, south of the city; 92 paces northwest of the northeast corner of a one-story brick powder magazine, 80 paces north of the northwest corner of same, and 6.05 meters east of small eucalyptus tree; marked by tent peg driven flush with the ground and covered with earth. The following true bearings were determined: minaret of Mohammedan monastery on southwest side of salt marsh on border of park, 57° 19′.4; lightning rod at east end of powder magazine, 323° 17′.3.

INDIA.

Dehra Dun, Agra, 1909.—Observations were made in the north and south absolute houses of the magnetic observatory for intercomparisons of standards.

Gwadur, Baluchistan, 1909.—On the east side of sandy isthmus connecting Gwadur Head with the mainland; north of the settlement and nearly abreast of the Residency bungalow, 21 paces from edge of sand bank leading down to the water and about 50 paces from water's edge at full tide; marked by wooden post 6 by 6 by 25 inches (15 by 15 by 64 cm.) projecting 2 inches (5 cm.) above ground. The following true bearings were determined: lowest visible section of flagstaff in front of telegraph office, distant three-eighths of a mile (0.6 km.), 5° 24′.2; tree on Ras Nuh, distant 3 miles (4.8 km.), 300° 10′.7 (prominent tree used by vessels).

Kizil Langar, Kashmir, 1909.—About 28 miles (45 kilometers) south of Karakorum Pass, in the narrow gorge which is entered after descending from the Dipsang Plain, about halfway down the gorge and near an earthen pillar resembling a Chinese li pillar.

Leh, Kashmir, 1909.—In small terraced field in front of south gate of the Commissioner's residence; 57 feet (17.4 meters) and 62 feet 10 inches (19.15 meters) respectively from the west and east sides of gate entrance, 133.5 feet (40.69 meters) from northwest corner of meteorological station and 40 feet 4 inches (12.29 meters) from the rock fence east of station. The southwest corner of shrine on hill is in true bearing 349° 09′.6.

Mulbec, Kashmir, 1909.—In the open space in front of the dak bungalow and about 200 feet (61 meters) southeast of bungalow; 61 feet 4 inches (18.69 meters) from a tree near south corner of low brick wall inclosing the yard, and 57 feet (17.4 meters) from a tree southwest of station. The following true bearings were determined: the northwest corner of bungalow, 127° 06′.3; pole supported by a stone cairn on top of prominent isolated rock about one mile distant, 279° 19′.3.

Panamik Ladak, Kashmir, 1909.—Northeast of the serai or inn-yard where the Kotidar of Panamik has his granary and where the business of village is transacted. A large shrine is in front of the serai and the station is 21 paces northeast of the tall tower of the shrine and 28 paces due north from its other end; a large tree, near which is a threshing floor, is 18 paces southeast from station. The east edge of large shrine on hillside is in true bearing 52° 31′.0.

ASIA.

INDIA—*concluded.*

Sonamarg, Kashmir, 1909.—82 yards (75 meters) northwest of, and on line projected from, south side of dak bungalow.

Srinagar, Kashmir, 1909.—In the compound of the Nedon Hotel, in the large open space southeast of hotel; 115 feet 4 inches (35.15 meters) due east of east edge of brick platform around the well, 74 feet 7 inches (22.73 meters) from board fence north, and 132 feet (40.2 meters) from board fence east of station; marked by a tent peg with brass ferrule around the top driven flush with ground. The following true bearings were determined: northeast corner of brick residence just west of hotel, 82° 03′.3; minaret on old temple on high hill, 260° 02′.3.

JAPAN.

Kisarazu, Tokaido, 1906.—On east shore of Tokio Bay, in the village, in an open space near the landing wharves, 38.5 feet (11.73 meters) east of the sea wall; marked by a wooden peg. A secondary station is about 50 feet (15 meters) north of principal station.

Sugita, Tokaido, 1906.—On west shore of Tokio Bay, in village of Sugita, on a small inlet known as Mississippi Bay. It is in an old garden about 15 feet (4.5 meters) from the open shore and about 75 feet (23 meters) from road running through Sugita to Yokohama. Observations were also made at a secondary station about 60 feet (18 meters) southwest of principal station.

Tokio, Tokaido, 1906.—On grounds of the Tokio Imperial University at a point about 30 feet (9 meters) north of the magnetic house in playgrounds of the University and in line with lightning rod on Science Hall, the true bearing of which, as furnished by Dr. Tanakadate of the University, is 179° 54′.6; marked by wooden peg. A secondary station is about 30 feet (9 meters) west of principal station.

PERSIA.

Ahwaz, Arabistan, 1909.—On playground rented by European residents in the town called Naseri at foot of Ahwaz Rapids, a mile (1.6 kilometers) south of Ahwaz proper. The playground is in eastern part of town, about three-eighths mile (0.6 kilometer) from the river. The magnetic station is in northern part of inclosure, 11.8, 57.2, 118, and 42.9 feet (3.6, 17.4, 36.0, and 10.0 meters) from the north, east, south, and west walls respectively; also in line with middle line of tennis court; temporarily marked by wood stake driven flush with ground.

Bam, Kerman, 1909.—In center of large garden in rear of Indo-European Telegraph Company's station on southwestern edge of town. The garden is approximately square, about 100 paces (76 meters) on a side. Near the center is a small square of ground about 20 feet (6.1 meters) on a side, formerly the grave of the owner's father; the magnetic station is at center of this burial plot. Narrow double walks run from the central square to the four walls of garden, the space between the walks being planted with palms and shrubs. The four quarters of the garden are devoted mainly to grape culture.

Bampur, Kerman, 1909.—On sandy elevation south of the south wall of fortifications and northwest of town; 204 feet (62.2 meters) from nearest angle of south wall of fort, and 209 feet (63.7 meters) from a wall to the eastward surrounding a small cultivated garden, the distances being measured along the uneven ground.

ASIA.

PERSIA—*continued.*

Binab, Azerbaijan, 1908.—Nearly in center of the open space back of the caravansary called "Tomaniants" (Armenian owners). This space is about 125 feet (38.1 meters) square and is apparently used for a dumping ground for refuse; but there is no evidence of local disturbance.

Bushire, Faras, 1909.—Two stations were established on the open ground in front of the British residency or consulate. Station A is on the hockey ground in line with north wall of consulate, 138.5 feet (42.2 meters) from northwest corner of consulate, 40 paces from a wall to the south of the grounds, and 58.6 feet (17.9 meters) from the seawall. Station B is 106.5 feet (32.5 meters) north of Station "A" and on line bearing 5° 15′ east of true north.

Dehbid, Faras, 1908.—On premises of Indo-European Telegraph Department. The property fronts towards the southwest and is approximately 130 feet (40 meters) wide and 220 feet (68 meters) deep. A paved walk 10 feet (3.0 meters) wide and 100 feet (30.5 meters) long with low walls on either side leads from gate to entrance of building. Observations were made at a point 19.4 feet (5.9 meters) from wall on southeast side of walk, and 29.8 feet (9.1 meters) from nearest corner of telegraph station; 33.4 feet (10.2 meters) from southeast wall of the property and 69.7 feet (21.2 meters) from southwest wall.

Dikantepe, Azerbaijan, 1908.—In garden belonging to Kyokha Habib, owner of the Manzil; about 150 feet (46 meters) from west wall of garden and just south of the opening in a double row of tall poplars lining the south side of a broad grassy walk.

Hamadan, Hamadan, 1908.—On the new property of American Mission in southern part of city, about 156 feet (47.6 meters) from south wall of property and 110 feet (33.5 meters) from southwest wall; marked by sandstone post 8 by 12 by 16 inches (20 by 30 by 41 cm.) set flush with ground. A true north and south line is scratched in top of stone. The southeast corner of new hospital about 600 feet (183 meters) distant, at middle of second story, bears 194° 41′.4. A secondary station was established 100 feet (30.5 meters) from main station on line to southeast corner of hospital.

Ispahan, Ispahan, 1908.—In the large garden of property owned by the Imperial Bank of Persia and reserved for residences of English officials of the bank. This property is in the center of the city, near the British Consulate, about three-quarters mile (1.2 kilometers) west of square known as Meidan-i-Shah and about the same distance north of river. The station is about 100 feet (30 meters) south of north wall of garden, about 160 feet (50 meters) east of house occupied by Mr. Gibbs, the accountant of the bank, and about 235 feet (72 meters) from south wall of garden, at the intersection of two of the broad paths which cross at right angles and divide the garden into squares of about 100 feet (30 meters) on a side; marked by stone post about 5 by 7 by 20 inches (13 by 18 by 51 cm.) set just below level of path; top of stone marked C. I. 1908. A secondary station was also occupied in the yard of the telegraph station.

Jask, Faras, 1909.—West of block of telegraph buildings and nearly in line with north wall of telegraph office; 287 feet (87.5 meters) from main astronomical pier in front of telegraph office, and 137 feet (41.8 meters) from nearer edge of broad walk leading straight out from Superintendent's house to sea; marked by copper nail in top of sandstone post with cement cap 6 by 6 by 24 inches (15 by 15 by 61 cm.), projecting about

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PERSIA—*continued.*

Jask, Faras, 1909—*continued.*
2 inches (5 cm.) above ground. The following true bearings were determined: cross on conspicuous white monument near end of cape, 27° 29′.6; left-hand edge of store house (northernmost building of telegraph station), 195° 58′.1; beacon marking anchorage ground east of telegraph cables, 293° 27′.2.

A secondary station was established 169 feet (15.5 meters) northeast from main station and in line of cross on conspicuous white monument and main station.

Kashan, Irak Ajemi, 1908.—North of Indo-European Telegraph Company's station, near northwest side of a large square of cultivated ground which surrounds property of the company. This square is outlined by sections of mud wall and is divided into rectangular portions by irrigation ditches. The station is marked by an octagonal stone about 6 inches (15 cm.) in diameter and 20 inches (51 cm.) long, set nearly flush with surface of ground; it is 29 feet (8.8 meters) from northwest boundary of field and 187 feet (57.0 meters) from north corner of telegraph station. The spike on apex of blue tiled dome of "Mesjid-i-Agha," 1½ miles (2.4 kilometers) distant, bears 46° 21′.4. The telegraph station is about 330 yards (0.3 kilometer) outside the city proper.

Kazvin, Kazvin, 1908.—In a large garden belonging in part to Mr. Ovanatanoff, telegraph operator of the Indo-European Telegraph Company's office in Kazvin, 191 feet (58.2 meters) east of the west wall of the garden, 179 feet (54.6 meters) from the old city wall running along southeast side of the garden, and about 500 feet (150 meters) from southwest corner of the garden. The elaborate Teheran gate at the east end of the main street in Kazvin is in full view from the station at a distance of about 800 feet (240 meters). The station is marked by a white limestone post 6 by 6 by 24 inches (15 by 15 by 61 cm.), projecting 3 inches (8 cm.) above ground. The spike in blue tiled dome of the mosque "Mesjid Shahzade Hussein" bears 87° 11′.2.

Kerman, Kerman, 1908.—Near northwest corner of British consulate garden, 72 feet (22.0 meters) from north wall, 45 feet (12.3 meters) from west wall, and 202 feet (61.6 meters) from nearest column of the consulate veranda; marked by white stone 9½ by 9½ by 24 inches (24 by 24 by 61 cm.), set nearly flush with ground and lettered C. I. 1908. The left-hand corner of a large niche in south wall of court yard visible from the magnetic station through a gate in the wall separating the yard from the consulate garden, and estimated distant 400 feet (122 meters), bears 337° 17′.7. Observations were also made at a secondary station at a point on the line from main station to azimuth mark above indicated and distant 156 feet (47.6 meters) from main station.

Kermanshah, Kermanshah, 1908.—On property of British consulate, on rising ground at upper or southern end of town, about 50 paces from the consulate building and 15 paces from corner of tennis court; marked by a stone post 6 by 6 by 27 inches (15 by 15 by 69 cm.), projecting 2 or 3 inches (5 or 8 cm.) above ground. The spire of the mosque called "Mesjid-i-Imad-i-Douleh" bears 178° 42′.2. The spire is the higher and more westerly of two spires which appear very near together from the station.

Khoi, Azerbaijan, 1908.—On roof of house belonging to Mr. Stepan Aratunian, in charge of the American Mission at Khoi. The house (constructed chiefly of mud with roof timbers, in which there is no iron) is situated about 2 kilometers west of the walled town.

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PERSIA—*continued.*

Linga, Faras, 1909.—In central part of town, in the garden belonging to the native British Agent, Khan Sahib Aga Beder; 132, 83, 181, and 104 feet (40.2, 25.3, 55.2, and 31.7 meters) from the north, east, south, and west walls respectively; marked by copper nail in top of a plaster and sandstone post 7 inches (18 cm.) square and projecting 2 or 3 inches (5 or 8 cm.) above ground. The garden is filled with low palm trees. A minaret about 400 yards (365 meters) distant bears 145° 20′.1.

Mohammera, Arabistan, 1909.—Three stations were established on the plot of ground in front of quarantine station, on south side of Karun River, about one-quarter mile (0.4 kilometer) from its junction with the Shatt el Arab and a mile below the town Mohammera. Station A is 48.2 feet (14.7 meters) in front of west side of main entrance of quarantine house. The base of flagstaff on custom house bears 98° 12′.3. Station B is 45.7 feet (13.9 meters) in front of west wing of house and 103.1 feet (31.4 meters) from station A. The flagpole on wharf or jetty at junction of the two rivers bears 88° 53′.0 west of south. Both stations are about 30 feet (9.1 meters) from the raised path along the river. Station C is 53.5 feet (16.3 meters) in front of east wing of quarantine station and 26.5 feet (8.1 meters) from east wall. The azimuth mark, same as from station B, bears 86° 40′.2.

Reshire, Faras, 1909.—On the property of Mr. Mohammed Karrim Amintojar, directly south of telegraph office, in an open field 31 feet (9.4 meters) west of a path crossing the field, and 117 feet (38.7 meters) south of an iron fence bounding the telegraph property. The flagstaff at the British Residency about a mile (1.6 kilometers) distant, bears 306° 30′.8. Observations were made at a secondary station 133 feet (40.5 meters) from main station and on line to azimuth mark.

Shiraz, Faras, 1908.—In the garden belonging to the Indo-European Telegraph Company, outside and north of the city proper. The garden is a square about 520 feet (158 meters) on a side, containing dwellings, telegraph office, tennis courts, etc. The magnetic station is located in the extreme south corner, 45 feet (13.7 meters) from southeast wall, and 77.5 feet (23.6 meters) from southwest wall; marked by a stone about 8 inches (20 cm.) square and 28 inches (71 cm.) long, projecting 8 inches (20 cm.) above ground.

Shushter, Arabistan, 1909.—Two stations were established at Shushter, on top of the little hill called Kalat Haji Amin, in northern part of town. This hill seems to be formed from the disintegration of ancient ruins and is, with one possible exception, the highest land in Shushter. Station A is located on western end of nearly horizontal ridge. The dome of a white mosque called Pir-i-Saadaat, about three-fourths mile (1.2 kilometers) distant, bears 15° 23′.6. Station B is 74 feet (22.6 meters) 49° 20′ east of south from station A, on a little flat near eastern end of ridge. The azimuth mark, the same as from station A, bears 16° 57′.6.

Tabriz, Azerbaijan, 1908.—Observations made at three stations: The principal station was in the boys' playground of the American Mission, 20 feet (6.1 meters) from south wall and 30 feet (9.1 meters) from west wall; shrine on hill to northeast bears 226° 19′.5. A second station was established in the garden of the American Mission on the walk south of tennis court, 16.9 feet (5.2 meters) from corner of the wall by the tennis court, 75 feet (22.9 meters) from west wall, and 71 feet (21.6 meters) from Dr. Wilson's house. The shrine on hill to northeast bears 227° 55′.3. The third

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PERSIA—*concluded.*

Tabriz, Azerbaijan, 1908—*continued*
station was near the north side of the garden of the American Consulate, opposite the middle walk of the garden, 5 feet (1.5 meters) from north wall, about 60 feet (18.3 meters) from west wall, and about 60 feet (18.3 meters) from the main entrance. This station is from 0.5 to 1 kilometer northeast from the Mission garden. Diurnal variation observations in declination were made at a station, designated as 3A, 124 feet (37.8 meters) south of the third station in the path and 23 feet (7.0 meters) from south wall garden.

Teheran, Teheran, 1908.—At center of lot adjoining and belonging to Protestant cemetery, about a mile (1.6 kilometers) west of city wall of Teheran. The lot is 377 feet (114.7 meters) long and 206 feet (62.8 meters) wide, and is bounded on the east by the west wall of cemetery, and on the north, west, and south by a shallow trench. The northwest and southwest corners are marked by pillars of mud brick. On account of contemplated grading no permanent mark was set, but the station may be recovered by measurement.

Yezd, Faras, 1908.—In southeastern part of city, on the lot of land now rented by Mr. Eldrid, manager of the Imperial Bank of Persia. The lot is one of a group of four similar lots, two of which are rented by the bank officials and two by the Indo-European Telegraph officials. The station is 28.9 feet (8.71 meters) and 69.8 feet (21.13 meters) respectively from the southeast and northeast walls of the lot, and 63.5 feet (19.35 meters) from center of tennis court; marked by a stone 8½ inches (22 cm.) square and 22 inches (56 cm.) long, buried with the top 3 inches (8 cm.) below the ground. The flagstaff over the entrance to the house occupied by Mr. Blackman, the superintendent of the telegraph station, bears 160° 34′.2.

Zenjan, 1908.—In southern part of town, in garden called Essed-i-Douleh, 38 feet (11.6 meters) south of caravansary of the same name, and opposite a point 33.5 feet (10.2 meters) east of southwest corner. The garden is about one-fourth mile (0.4 kilometer) square and filled with fruit trees; the caravansary is about the middle of the northern side of the garden.

Zergendeh, Irak Ajemi, 1908.—Near village of Zergendeh, 6 miles (10 kilometers) northeast of Teheran and 3 or 4 miles (5 or 6 kilometers) south of the Tochal Mountain; on the shoulder of a low hill about 0.2 mile (0.4 kilometer) west of the most southerly of a group of white houses in the village; marked by a boulder about a foot (0.3 meter) in diameter, which was half buried. The left and higher chimney of mint, about 1½ miles (2.5 kilometers) distant, bears 316° 27′.7.

TURKISH EMPIRE.

Adabazar, Ismid, 1910.—South of town on a hill east of the Angora road, which at this point makes a turn from a southerly to an easterly direction, east of an old deserted military barracks; 142 paces from southeast corner of east wing of the old barracks, and 134 paces from northeast corner of the east wing; marked by a tent peg driven flush with the ground. The following true bearings were determined: tall lone minaret in eastern part of Adabazar, 223° 37′.3; north gable of eastern wing of barracks, 81° 00′.7.

Adana, Adana, 1910.—In a meadow about 1½ miles (2.4 kilometers) west of town on road leading to Mersina, and west of north-and-south road which crosses the Mersina road and also the railroad. At the railroad crossing there is a small building marked "Jardin

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TURKISH EMPIRE—*continued.*

Adana, Adana, 1910—*continued.*
Chakir Pasha" which appears to be a railroad station. At the intersection of the north-and-south road with the Mersina road there is a large dilapidated and at present uninhabited building called "Chakir Pasha." The station is about 300 yards (274 meters) south of this building, 8.9 meters west of the north-and-south road, and 23.75 meters east of large spreading mulberry tree standing near the center of the meadow; marked by pine stake 1½ by 2 by 15 inches (4 by 5 by 38 cm.) driven flush with ground and covered with earth. The following true bearings were determined: lightning rod on chimney of German cotton factory, 259° 52′.6; cross on large white steeple of English church, 279° 15′.8; east gable of uninhabited building near cross roads, 185° 45′.4.

Aden, Arabia, 1909.—On the circular plot of ground surrounding statue of Queen Victoria, in eastern part of settlement about 4 miles (6 kilometers) from Aden and known as Steamer Point. The statue is at about the center of a tract of land known as the "Crescent," so called on account of the nearly semicircular street bordering it on the south side. The magnetic station is west of the middle point of the square base of the statue and 31.4 feet (9.5 meters) from the rise of the bottom step. The following true bearings were determined: flagstaff at Shum Shum signal station, about 2 miles (3 kilometers) distant, 296° 45′.7; clock tower on hill east of the Crescent, about 0.3 mile (0.5 kilometer) distant, 105° 54′.5.

A secondary station (designated "North") is directly north of the middle point of the square base of the statue, 61.5 feet (18.7 meters) 45° 44′ east of true north from the main station, and 23.5 feet (7.2 meters) from the rise of the bottom step on north side of statue.

Afiumkarahissar, Brusa, 1910.—About 1¼ miles (2 kilometers) east of railroad station, northwest of road leading from railroad station to marble quarries, and on the east bank of small muddy sluggish stream called Akar; marked by a pine stake about 1 by 3 by 12 inches (3 by 8 by 30 cm.) driven flush with ground. The following true bearings were determined: minaret of great white mosque with two domes in Afiumkarahissar, 67° 49′.3; minaret in village of Sipsin, 158° 58′.9.

Aidin, Smyrna, 1910.—North of town of Aidin, on west bank of a small stream called Evthon, where the Aidin road crosses the stream. On the west bank of the stream at this point a cliff rises more than 100 feet (30 meters). The station is on a small level plat of ground between the stream and a higher bank, 33.25 meters southwest from southeast corner of a coffee house in a grove of plane trees, 29 meters south of large plane tree at south end of coffee house, 16.2 meters east of end of stone wall on west bank of stream, and 14.7 meters northeast of large willow tree between the stream and stone wall. It is marked by tent peg driven flush with ground and covered with earth. The following true bearings were determined: crescent on municipal building, 6° 38′.3; north gable of Greek Metropolis (residence of bishop), 345° 54′.6.

Ain-el-Bieda, Syria, 1910.—At fort called Ain-el-Bieda, which is a police station on the Syrian desert consisting of a single stone building; almost in line with front wall of fort, 34.6 meters west of southwest corner of building, 38.0 meters southwest of northwest corner of building, and 45.75 meters northwest of edge of well south of the fort; marked by pine stake about 2 by 2 by 10 inches (5 by 5 by 25 cm.) driven flush with ground.

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TURKISH EMPIRE—*continued.*

Aintab, Aleppo, 1910.—On football field south of Central Turkey College grounds; 0.45 meter east of small drain running along western edge of field, 51 paces southwest from gate in south wall of college grounds, 81 paces southwest of the northeast corner of the stone wall around college grounds; marked by tent peg driven flush with ground and covered with earth. The flagpole on Dr. Goodsell's house in Central Turkey College grounds is in true bearing 201° 53′.8.

Alashehr, Smyrna, 1910.—To the north of town, in a vineyard belonging to Theologhos Haji Slothoglou, on west side of road Ahmed Beyli Jatdesi; 125 paces north of mud gate roofed over with tile on west side of road, and 7 meters west of center of road; marked by a round tent peg about 1 inch (3 cm.) in diameter driven flush with ground and covered with earth.

Aleppo, Aleppo, 1910.—On lofty hill above and north of park called the Sebil, north of city, on east side of Aleppo-Alexandretta road; about on a line through a large oval hill on plain to the south and the center of the great citadel in Aleppo; 176 paces from the southeast corner of the stone tower of the windmill to the westward, 183 meters from the northeast corner of the same tower, 11 meters north of center of nearest edge of small stone quarry and several hundred yards south of a large stone quarry; marked by a tent peg driven flush with the ground and covered with earth. The following true bearings were determined: minaret of mosque in front of center of barracks, 297° 37′.3; minaret on citadel, 317° 24′.3; minaret of mosque near railroad station, 358° 50′.1.

Alexandretta, Adana, 1910.—East of the town, on an open stretch of seashore between two root baling factories; about 366 paces west of main entrance on west side of inclosure around root factory to the east 171 paces northwest from entrance to old abandoned gendarmerie post on south side of road, 144 paces southeast of northeast corner of stone wall around root factory to the west, 140 paces northeast of southeast corner of same wall, about 54 paces south of the sea, and about 32 paces north of road to Alexandretta; marked by tent peg driven flush with ground and covered with earth. The cross on church steeple in Alexandretta is in true bearing 88° 40′.6.

Angora, Angora, 1910.—On north side of a small stream in a meadow on west side of road between railroad station and Angora; 10.4 meters southeast of the end tree of a row of willows to the west, and 55.75 meters northwest of center of northwest end of first stone culvert north of entrance to the meadow; marked by tent peg driven flush with ground. The following true bearings were determined: flagpole on citadel in Angora, 257° 55′.5; ornament on chimney of building at railroad station, 55° 36′.7.

Bagdad, Bagdad, 1910.—Northeast of city and northeast of burial place known as the English cemetery in a shallow valley formed by the excavation of clay for brick; 43.8 meters northeast of a corner in northeast side of brick wall about the cemetery, and marked by a tent stake. The following true bearings were determined: spire on large white dome of the Mosque Sheik Abdul-Kadar Gilany, 121° 33′.0; clock tower of the mosque, 123° 24′.0; striped minaret with green fluted top, of the mosque, 123° 32′.2.

Bahrein Island, Persian Gulf, 1909.—On property of American Mission, 11.8 feet (3.6 meters) from north wall, 95.5 feet (29.1 meters) from bottom step of main entrance and midway between east and west walls; marked by brass screw in hardwood post 5 by 5 by 20 inches (13 by 13 by 51 cm.) set flush with ground.

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TURKISH EMPIRE—*continued.*

Bahrein Island, Persian Gulf, 1909—*continued.*
The following true bearings were determined: base of flagstaff on large fortress (summer residence of the local Sheik) about a mile (1.6 kilometers) distant, seen through main gate of mission grounds, 40° 18′.9; right-hand corner of servants' quarters where the latter join the west wall of the property, 1° 13′.5; northwest corner of mission hospital, 64° 51′.7. Observations were made at a secondary station, 78.3 feet (23.9 meters) from main station and on line from main station to base of flagstaff on large fortress.

Basra, 1909.—At north end of garden owned by McAndrews & Forbes Co., licorice dealers and manufacturers. The garden in about 400 feet (122 meters) wide by 1000 feet (305 meters) long, planted in date palms, and fronting on Hakimieh Creek, about 2 or 3 miles north of the old city of Basra. The magnetic station is on a ridge of earth formed from excavations of the irrigation ditches of garden and is very nearly at the middle of northwest boundary of the property. A secondary station was established about 23 paces southwest of main station and on same ridge of earth.

Beirut, Beirut, 1910.—In southeastern part of city, on an irregular sandhill, the southwest portion of which is used by American and English residents of Beirut as a golf grounds, and the northeast portion is a cemetery; in southwestern part of the cemetery, adjacent to golf grounds and southwest of a square stone building in the cemetery, being 22 meters and 27.4 meters respectively from the southwest and southeast corners of this building; marked by pine stake about 14 inches long driven flush with ground and covered with earth. The following true bearings were determined: lightning rod on tower of Syrian College, 163° 03′.8; top of lighthouse to the northwest, 121° 46′.0.

Birejik, Aleppo, 1910.—About one-fourth mile (0.4 kilometer) west of the west bank of the Euphrates River, at a point where the level plain rises into a low plateau, on which there is a cemetery containing a huge walled tomb considered as a holy place and in the keeping of a water vender; about 200 yards (183 meters) north of a small grove, 37.45 meters southeast of southeast corner of wall around tomb, and 25.15 meters southwest of large spreading mulberry tree; marked by tent peg driven flush with ground and hidden by the grass. The following true bearings were determined: more northerly of two minarets in Birejik, on east bank of river, 279° 30′.6; more southerly of two minarets in Birejik, on east bank of river, 289° 53′.7; spike on dome of holy tomb, 165° 52′.4.

Billis, Billis, 1910.—About 2½ miles (4 kilometers) north of town, on north side of road from Mush to Bitlis, about one-third mile (0.5 kilometer) southeast of village of Pashenk, and about one-fourth mile (0.4 kilometer) or more northwest of Pashenk Khan, a square stone building on west side of road. It is east of the ruins of a small Armenian church, on a grassy slope which separates a cultivated field from a marshy meadow, 116 paces east of large spring north of the church, and 5.2 meters west-southwest of the most westerly tree of a row of three willows standing east and west on the marshy meadow; marked by tent peg driven flush with ground. The following true bearings were determined: north corner of Pashenk Khan at eaves, 337° 53′.7; west corner of Pashenk Khan at eaves, 340° 49′.5.

Damascus, Syria, 1910.—Southeast of city of Damascus, on a plain used by the Turkish troops as a drill ground, lying between the Greek Catholic Cemetery and a large olive grove, both inclosed by mud walls. It is

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TURKISH EMPIRE—*continued.*

Damascus, Syria, 1910—*continued.*
in the southeast corner of the plain, 25 meters east of the northeast corner of large stone vault in the ancient neglected cemetery situated on a hill rising abruptly from the plain; 15.5 meters north of northwest corner of mud wall to southward; 11.6 meters northwest of two large stones that serve as foot bridge across a stream bed now dry except for a few stagnant pools, and 2.8 meters west of stream bed; marked by pine stake driven into the ground and covered with earth. The following true bearings were determined: east minaret of the Great Mosque, 126° 21′.6; point on dome of the Great Mosque, 124° 58′.4; west minaret of the Great Mosque, 122° 55′.0; cross on dome of large mausoleum in the Greek Catholic Cemetery, 120° 34′.3.

Dardanelles, Bigha, 1910.—About 2½ miles (4 kilometers) south of town, on east side of road which follows the shore of the strait to this point and then continues south through the country; southeast of a fountain on east side of road, about 145 paces southwest of a spring which is covered over with brick masonry work, and in line between two trees standing on the brow of the hill, being 22.0 meters north-northeast of the one and 36.5 meters south-southwest of the other; marked by tent peg driven flush with ground and covered with earth. The following true bearings were determined: lighthouse to southwest, 65° 41′.4; square white church tower in Dardanelles, 177° 40′.5.

Denizli, Smyrna, 1910.—Northeast of town, on property belonging to Keurjan Mahleli Khaphiz Eminoglou Ahmed; 57 paces southeast of entrance to the grounds, 36.7 meters west of well-foliaged tree in cultivated field on northeast side of road, 14.6 meters southeast from east corner of mud wall inclosing property, 5 meters due west of center of road, and 4.50 meters northeast of center of ditch along southwest side of road; marked by pine stake about 1 by 2 by 12 inches (3 by 5 by 30 cm.) driven flush with ground and covered with earth.

Dera'a, Syria, 1910.—The town of Dera'a is about 2 miles (3 kilometers) southwest of the junction of the Haifa-Damascus and the Hejaz (Damascus-Mecca) railroads. The magnetic station is 56.1 meters west of south corner of stone wall surrounding two buildings of the railroad company on northwest side of the road running from railroad station to the town of Dera'a, 52.9 meters southwest from west corner of stone wall, and 21.25 meters northwest of row of stones embedded in the earth along northwest side of road; marked by tent peg driven flush with ground and covered with earth. The following true bearings were determined: minaret in Dera'a, 24° 53′.5; southwest gable of railroad station, 202° 34′.9.

Diarbekir, Diarbekir, 1910.—About a mile (1.6 kilometers) west of the city of Diarbekir and near the village of Ali Pounar, on the north side of Aleppo-Diarbekir road, opposite the end of road running south to Ali Pounar; 28.5 meters east of the northeast corner of mud wall around gendarme post, 52.0 meters northeast of the southeast corner of mud wall, and 55.0 meters north of the corner of a low stone wall on south side of road; marked by tent peg driven flush with ground and covered with earth. The square black minaret in Diarbekir is in true bearing 262° 01′.4.

Egin, Kharput, 1910.—On the north corner of a bluff southeast of ruins of an Armenian church west of and on higher ground than the town; 34 meters northwest of east corner of retaining wall running along southwest side of road leading up the bluff from the town, 28 paces east-northeast of most easterly point of a

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TURKISH EMPIRE—*continued.*

Egin, Kharput, 1910—*continued.*
large boulder, 16 paces north of north corner of retaining wall to southeast of large boulder, and 22 paces north of east corner of the same retaining wall; marked by tent peg driven flush with ground and covered with earth. The following true bearings were determined: most westerly of three visible minarets, 146° 13′.6; central one of three visible minarets, 150° 37′.2; most easterly of three visible minarets, 170° 29′.0.

Eregli, Konia, 1910.—On the north side of road running from railroad station and passing in front of railroad hospital, where it intersects a road which runs off northeast to town of Eregli; 118 paces east-southeast of main entrance to railroad hospital and 100 paces east of large double walnut tree in southwest corner of the two roads; marked by tent peg driven flush with ground and covered with earth. The following true bearings were determined: flue on west side of main building at railroad station, 292° 45′.0; south front gable of railroad hospital, 124° 06′.6.

Erzerum, Erzerum, 1910.—In north corner of a cultivated field in eastern part of town, between a large cemetery and the wall of fortifications surrounding the town, a short distance west of a ravine, and south of the road which leads from the town into the ravine and under the fortifications into the plain beyond; 69.6 meters, 59.6 meters, and 73.25 meters respectively from the east, south, and west corners of wall around the sheikh's burying ground to the northeast; marked by tent peg driven flush with ground and covered with earth. The following true bearings were determined: tall minaret in Erzerum, 149° 01′.0; flagstaff on clock tower on citadel, 121° 16′.6.

Erzingan, Erzerum, 1910.—In a field about 400 paces southwest of the large Armenian cemetery just outside the city, on southeast side of road to Gemakh, Arabkir, and Kharput. The cemetery contains a thick grove of trees and is surrounded by a mud wall. The station is near a grove of four trees at the junction of several irrigation ditches, 16.8 meters southwest of large willow tree, and 18.6 meters south of large elm tree; marked by tent peg driven flush with ground and covered with earth. The following true bearings were determined: western of two minarets of mosque Yeni Djami, 242° 14′.0; eastern of two minarets of mosque Yeni Djami, 242° 36′.4.

Eskishehr, Brusa, 1910.—About a mile (1.6 kilometers) west of railroad station at Eskishehr, on northeast side of road leading from Eskishehr to Brusa and southwest of an oval-shaped hill covered with vineyards and orchards on a small piece of meadow land northeast of a small stream which crosses the Brusa road; 26 meters northeast of northeast corner of wooden bridge across stream, 24 meters northeast of northeast end of center pier of bridge, 17.7 meters southwest of willow tree standing on west bank of the stream, and 4.5 meters northwest of edge of stream; marked by a tent peg driven flush with ground and covered with earth. The lightning rod on chimney of railroad machine shops is in true bearing 329° 19′.0.

Gemakh, Erzerum, 1910.—In a field south of main part of village, which is between the cliffs on the east bank of the West Euphrates; in the north corner of the field at foot of the bluff west of a brook, 15.1 meters northwest of first tree to the southeast, 13.9 meters southeast of first tree to northwest, and 11.2 meters west of tree on side of bluff to the east; marked by tent peg driven flush with ground and covered with earth.

ASIA.

TURKISH EMPIRE—*continued.*

Haifa, Beirut, 1910.—Near south corner of garden in rear of German Catholic Hospice; 20.15 meters southwest of large double orange tree standing in row bordering on cultivated ground to the north; 11.1 meters southeast of small drain leading from reservoir onto cultivated field; 9.6 meters west of walled excavation, and 7.4 meters east of last tamarisk at southeast end of row bordering on southwest side of walk leading to double gate; marked by tent peg driven flush with ground and covered with earth. The flue on west corner of main building of German Catholic Hospice is in true bearing 180° 35′.5.

Homs, Syria, 1910.—On the plain between railroad station and citadel, a huge earth fortification in southern part of town; about 125 paces southwest from the crossroads, 403 paces east of railroad station, 134 paces northeast of breach in wall around a filled well, 125 paces southwest of fountain in middle of road leading from Homs to the railroad, and 39 paces northwest of embankment on southeast side of road which crosses the railroad to the southwest; marked by tent peg driven flush with ground and covered with earth. The following true bearings were determined: minaret of tomb of Sayeed Halid, 210° 37′.4; spire on main dome of tomb of Sayeed Halid, 210° 20′.8.

Ineboli, Kastamuni, 1909.—The stations are located on a nearly flat grassy plot on the shoulder of the steep hill west of town. The place is easily recognized as the only approximately level ground on the west side of the valley in which the town is situated, and also marked by a conspicuous tree on apex of hill just above it to the southward. Station A is on the west side of the plot. A conspicuous minaret bears 270° 59′.1. Station B is 25 paces, 89° 00′.9 east of south of station A.

Jaffa, Jerusalem, 1910.—Northeast of the town of Jaffa, on road leading to Sarona (German colony), about 1¼ miles (2 kilometers) from the Jerusalem Hotel in Jaffa, and to the west of a stone quarry; about 112 paces northwest of the southwest corner of an old brick wall inclosing a large dwelling house, about 110 paces north of main part of small dwelling house, and 47 paces northeast of small tamarisk tree in cactus hedge running approximately north and south; marked by tent peg driven flush with ground and covered with earth. The following true bearings were determined: spire of church, Russian monastery, 17° 51′.4; spire of German Protestant Church in Jaffa, 64° 40′.8; spire near the sea, 70° 41′.2.

Jericho, Jerusalem, 1910.—On plain north of Dead Sea and west of village of Jericho, near an irregular stone inclosure called the "Pool of Moses." This "Pool" is 260 paces south of the road leading to Jericho and is said to have been used in former times for irrigation purposes. The station is in line with east wall of pool, and 11.5 meters north of eastern wall; marked by tent peg driven flush with ground and covered with earth.

Jerusalem, Jerusalem, 1910.—On the road leading to the Mount of Olives, in the southern part of a field belonging to the American Colony; about 400 yards (366 meters) almost due east and to the rear of Sheikh Jera'ah Mosque; about 200 yards (181 meters) northeast of Mohammed Salah's house; 31.7 meters northwest of east corner of stone wall inclosing field, 16 meters north-northwest of corner of wall to southeast, and 65 paces east-northeast of corner of wall to the west; marked by wooden peg. The following true

ASIA.

TURKISH EMPIRE—*continued.*

Jerusalem, Jerusalem, 1910—*continued.*
bearings were determined: minaret on Sheikh Jera'ah Mosque, 89° 13′.8; spire of church at Russian Monastery on Mount of Olives, 308° 44.′6.

Jezireh-ibn-Omar, Van, 1910.—About one-half mile (0.8 kilometer) south of town on a bluff on the east bank of the Tigris River; 7, 5, and 4 meters respectively from the west, east, and south edges of the bluff, and 25 meters from the point of the slope to southwest; marked by a tent peg driven flush with ground. The minaret visible from the station, in Jezireh-ibn-Omar, is in true bearing 13° 46′.8.

Kaisariyeh, Angora, 1910.—About one-fourth mile (0.4 kilometer) east of city of Kaisariyeh, in the uncultivated triangular portion of a field on southwest side of main road from Kaisariyeh to Tavlousoun, a suburb; a road which runs parallel to the main road branches at this point, one branch running through the western part of the field close to an irrigation ditch. The station is in the northwest corner of the plot, south of the irrigation ditch, 52 meters southeast of south corner of an old Persian tower, and 56 meters south of northeast corner of the tower; marked by tent peg driven flush with ground and covered with earth.

Kaleh Shergat, Mosul, 1910.—Probably on the site of the ancient Assyrian city of Assur, on the west bank of the Tigris River. A mound of ruins runs northwest from an ancient brick retaining wall at edge of river and to the northeast of the mound is a small plain bounded on the northeast by a shallow ravine. The station is 9.8 meters west of the junction of river and shallow ravine, 20.6 meters northeast from north corner of a shallow excavation on the bank of the river, 35.6 meters east of the most southerly tree in a grove near the mound of ruins, and 72 paces east of foot of mound; marked by tent peg driven flush with ground and covered with earth.

Karietein, Syria, 1910.—In a garden surrounded by mud walls and belonging to Ahmad El Fayad; 116 paces southeast of gate opening from Ahmad El Fayad's yard into the garden, 51 paces east of southwest corner of inclosure, and 15 meters northeast of southern corner of inclosure; marked by tent peg driven flush with ground and covered with earth. The edge of southern corner of Ahmad El Fayad's house is in true bearing 183° 53′.4.

Katrane, Syria, 1910.—On the plain west of the main railroad and northeast of some earthworks inclosing a windmill and old fortress or castle; 352 paces northwest of the southwest corner of railroad station, 116 paces northeast of a ravine, and 323 paces northwest of chimney on west end of building with an oval ridge near the main railroad track; marked by tent peg driven flush with ground and covered with earth. The following true bearings were determined: top of smaller of two domes on southeast corner of castle, 52° 03′.3; south gable end of the railroad station, 310° 12′.3.

Kharput, Kharput, 1910.—In the western corner of a field belonging to the American Mission Hospital, north of town, south of the road from Kharput to Mezreh, and northeast of the large vineyard inclosed by high mud wall; 28.6 meters east of the north corner of wall around vineyard and marked by tent peg driven flush with ground and covered with earth. The northwest gable of main building of Mission Hospital is in true bearing, 336° 05′.4.

ASIA.

TURKISH EMPIRE—*continued.*

Kirs, Bitlis, 1910.—Southwest of the village, about 125 paces south of road leading to Mush, 7.2 meters north of center of small mountain stream which flows southwest through the village, 34.5 meters west-southwest of a lone willow on south side of stream, and 13.7 meters north of a clump of willows on south side of stream; marked by tent peg driven flush with ground and covered with earth.

Kirshehr, Angora, 1910.—In a field inclosed by mud walls on southeast edge of town, northeast of a Moslem cemetery and east of main road leading south into cemetery; in a small rectangular plot on south corner of the field extending out southwest nearly to the road, 21.5 meters from south corner, 19.2 meters from southwest corner, 19.6 meters from angle in the wall northwest, and 23.5 meters from point where an outside wall joins the main wall; marked by a tent peg driven flush with ground. The minaret on same hill as Turkish College is in true bearing 171° 17′.9.

Konia, Konia, 1910.—Two miles west of the city, on north side of road running west from Konia to Beyshehr, southeast of suburb of Konia called Hodja Jikan, and about 300 yards (274 meters) northeast of stone fountain on a branch road; about 50 paces north of stone culvert under the main road, 3.2 meters due east of center of ditch which runs through the culvert, and in line with a row of olive trees standing north and south, about 7.6 meters north of the most northerly tree of the row; marked by a round tent peg driven flush with ground. The following true bearings were determined: clock tower, 282° 01′.9; pyramidal tower of great mosque on the hill of Ala-ed-din, 280° 52′.3.

Koweit, Arabia, 1909.—On south side of town, in inclosure where the camels of the political agent are stabled, and about three-fourths mile (1.2 kilometers) from the residency; in southwest corner of the inclosure, 23.1 feet (7.0 meters) from south wall, 24.3 feet (7.4 meters) from west wall, and about 100 feet (30.5 meters) west of the camels' stables. The top of flagstaff of the British residency seen over the north wall of the inclosure, distant about three-fourths mile (1.2 kilometers), bears 163° 46′.0. A secondary station was established 89 feet (27.1 meters) north of main station and in line with flagstaff of the British residency.

Kuteifeh, Syria, 1910.—Near the khan at entrance to village from Damascus; 40.7 meters northwest of northwest corner of mud-brick wall around the khan, 20 meters northwest of center of eastern end of stone arch over drain crossing the road, and 15.65 meters northwest of center of western end of stone arch across road; marked by a tent peg driven flush with ground and covered with earth.

Latakia, Beirut, 1910.—One-third mile (0.5 kilometer) north of pottery works on north edge of town; 131 paces north of an old windmill tower (about 200 paces from seashore), 102 paces north of an old well which is northeast of windmill tower; marked by tent peg driven flush with ground and covered with earth. The following true bearings were determined: minaret of mosque with two domes, 337° 50′.9; top of windmill tower, 4° 02′.9.

Ma'an, Hejaz, 1910.—On a plain west of railroad station at Ma'an, near the foot of the ridge on western edge of plain; 190 paces southwest of southwest corner of mud wall, 24.9 meters northeast of southeast corner of small stone building, 21.05 meters northeast of northeast corner of same building; marked by tent peg driven flush with ground and covered with earth. The top of middle chimney of railroad station is in true bearing 264° 47′.3.

ASIA.

TURKISH EMPIRE—*continued.*

Madain-Saleh, Hejaz, 1910.—On the plain about 350 yards (320 meters) southwest of railroad station, 95 paces west of south from west corner of mud brick building, 71 paces southwest from west corner of large mud brick building, and 76 paces southeast of south corner of mud brick inclosure; marked by tent peg driven flush with ground.

Madrak, Erzerum, 1910.—In valley of a mountain stream, about 2½ miles (4 kilometers) west of the village of Madrak, on a sloping plain south of a flour mill and of the quarantine station; 8.9 meters west of a ravine running into the mountains, 14.8 meters east of the mill race, 49.5 meters south of the southeast corner of mill, and 49.3 meters southeast of large willow tree overhanging the mill.

Malatia, Kharput, 1910.—East of the town, in a rectangular field on north side of road, northeast of military barracks, and just south of a wide gap in a row of apricot trees standing east and west across the center of the field; 32.5 meters southeast of a very large tree in western section of the row, 26.8 meters southeast of first tree west of the gap, 23.0 meters southwest of first tree east of the gap, and 34 meters north of the north corner of mud wall on south side of road; marked by tent peg driven flush with ground. The following true bearings were determined: minaret on military barracks, 100° 13′.1; flag pole in front of military barracks, 107° 17′.2.

Mamakhatun, Erzerum, 1910.—About one-half mile (0.8 kilometer) southeast of town, 125 paces west of the Tuzla Su, a short distance east of a threshing ground, and south of the U bend of the road from the town to the threshing ground; 128 paces south of the middle of the road on north side of field and 64 paces south of irrigation ditch on south side of field; marked by tent peg driven flush with ground and covered with earth.

Marash, Aleppo, 1910.—North of town, northeast of vineyard and orchard on an oval-shaped hill directed northwest and southeast and separated from the main mountain ridge by a narrow valley. The American Mission School, on a hill on the northern edge of town, is visible to the southwest. The station is 18.5 meters almost due north of an opening in hedge at southwest corner of orchard, and 62 paces southwest of north corner of low stone wall and hedge inclosing vineyard; marked by tent peg driven flush with ground and covered with earth. The flagpole on front of military barracks is in true bearing 67° 03′.8.

Mersina, Adana, 1910.—West of the town, a short distance southwest of the Mersina River, northeast of the seashore, and practically due west of the mouth of the River; 48.9 meters southwest of the west corner of a stone building which is the most northerly of four buildings along west bank of river, and 41.8 meters southwest of the south corner of stone building; marked by round stake about 2 inches (5 cm.) in diameter and 16 inches (41 cm.) long driven flush with ground. The tip of lighthouse on east bank of Mersina River is in true bearing 260° 18′.3.

Mosul, Mosul, 1910.—In an uncultivated field on east bank of Tigris River, directly across the river from the brick and stone military barracks at southeast corner of the city of Mosul; 96.5 meters north of the vertical shaft operating machinery of the more northerly of two horsepower machines used for lifting water from the Tigris River for irrigation purposes; an irrigation ditch runs north from this machine to a point 14 meters east of the station,

ASIA.

TURKISH EMPIRE—*continued.*

Mosul, Mosul, 1910—*continued.*
thence east 15.75 meters, and then again north. The station is marked by tent peg driven flush with ground. The following true bearings were determined: minaret over tomb of Nebi Yunus, 229° 12′.1; flagstaff at southeast end of the military barracks, 35° 14′.7; flagstaff at northwest end of the military barracks, 48° 28′.9; dome of Djami-ul-Ahmed in Mosul, 106° 25′.8

Nebk, Syria, 1910.—Southwest of town of Nebk; 70 paces southwest of junction of the Homs road with the Nebk-Damascus road, 21.5 meters southeast of corner of wall built of stone and mud near the Homs road, 16.5 meters measured due west from wall built of stone and mud running parallel with the Damascus road, and 5.9 meters measured due east from stone and mud wall standing at right angles to the Homs road; marked by tent peg driven flush with ground and covered with earth. The round ornament on gable over entrance to police station in Nebk is in true bearing 227° 21′.7.

Nisibin, Diarbekir, 1910.—About one and one-half miles (2 kilometers) east of Nisibin and about one-third mile (0.5 kilometer) north of the village of Mahmahki, on south side of Jezireh-Nisibin road, and west of a stream which furnishes power to the flour mill on north side of road; 6 meters west of a small marshy meadow, 76.6 meters south of entrance to mill, 78.1 meters southeast of southwest corner of mill, and marked by tent peg driven flush with ground and covered with earth. The minaret of mosque in front of barracks is in true bearing 83° 30′.4.

Osmanie, Adana, 1910.—On the plain to the northwest of intersection of the Osmanie road with the road leading to Bagche and Marash, and southwest of two houses belonging to Ayashi Ali Effendi; 54.5 meters northwest of the west corner of a mud hut at intersection of the roads, and 23.3 meters southwest of ditch running northwest and southeast along the Osmanie road; marked by tent peg driven flush with ground and covered with earth.

Ramadieh, Bagdad, 1910–1911.—About a kilometer east of town, southwest of large brick building belonging to the Wilcox Engineering Co., and known locally as the "Castle"; on a strip of elevated ground at a point 154 and 124 paces respectively southwest of the southwest corners of the Wilcox Company building and adjoining stable; marked by tent stake. The northwest corner of brick building of the Wilcox Engineering Co. is in true bearing 227° 38′.0.

Rhodes, Island of Rhodes, 1910.—On northern edge of town, north of a lighthouse on a sandy point (locally called "Koum Bournou") projecting into the sea; 124 paces north of the north corner of lighthouse, 143 paces north of the west corner of lighthouse, and 190 paces northeast of a ruined windmill tower; marked by a pine stake about 2 by 4 by 20 inches (5 by 10 by 51 cm.) driven flush with ground and covered with sand. The following true bearings were determined: light tower on ancient castle, 316° 54′.3; chimney of lighthouse on Koum Bournou, 349° 59′.6.

Samsun, Trebizond, 1909.—The stations are located on the flat ground east of the little river which flows down the great valley southeast of town. The main station is about 800 feet (244 meters) southwest of hippodrome, and roughly one-fourth mile (0.4 kilometer) from the seashore, the base of the hills to the southeast, the low hills on opposite side of river, and the stone bridge near mouth of river. The lighthouse appears over the west end of the stone bridge. The

1. Audience at Magnetic Station Binab, Persia.

2. Station Tabriz, I, Persia.

3. Station at Gwadur.

4. Station at Orenburg, Russia.

5. View Southwest to Station, Northeast Promontory, China.

6. Station at Tsinan, China.

Typical Field Views by Observers in Persia, Russia, and China.

ASIA.

TURKISH EMPIRE—*continued.*

Samsun, Trebizond, 1909—*continued.*
following true bearings were determined: flagstaff on south end of hippodrome, 221° 14′.1; minaret of mosque, 154° 04′.9; dome of Greek Church, 134° 14.′3; Samsun Lighthouse, 163° 45′.6. Secondary observations were made at a point 299 feet (91 meters) northwest of main station and in line with Greek Church.

Sazelar, Angora, 1910.—Between railroad and the Kutahya Su, 490 paces north of rear door of railroad station, and 4.4 meters south of bank of creek; marked by tent peg driven flush with ground.

Sert, Bitlis, 1910.—Southwest of town and north of road from Sert to Jezireh, about 150 yeards (137 meters) west of fountain at entrance to town. The land on north side of the road is laid out in terraces and the station is on the second terrace southwest of the town being 25, 40, 55 and 26 paces respectively from the northwest, northeast, southeast, and southwest corners of the terrace, and 9 paces from foot of the next terrace southwest. It is marked by a tent peg driven flush with ground and covered with earth. The following true bearings were determined: leaning minaret in Sert, 215° 19′.2; most westerly minaret in Sert, 149° 59′.8.

Sheikh Othman, Arabia, 1909.—On the broad open lot between the Mission House and the residency bungalow on Distillery Road; in line with outer edge of pillars supporting the Mission House veranda on the rear, and 86 paces from north corner of the building. The spike on the dome of the tomb of Sayid Hashim bears 103° 42′.8. A secondary station was established 131 feet (39.9 meters) east of main station and in line with the dome of the tomb of Sayid Hashim and main station.

Sivas, Sivas, 1910.—North of town, at the edge of the district inhabited by Armenians and called "Hokda," in the southeastern part of a field belonging to the American Mission and intended as the site of a normal school; 9.7 meters north of fountain on roadside, 44 meters northwest of the most westerly tree of a row of willows on other side of road, and 45 meters north of most northeasterly tree of grove of willows southeast of the Moslem cemetery across the road to the southwest; marked by tent peg driven flush with ground and covered with earth. The minaret of mosque on bluff to the eastward is in true bearing 293° 43′.5.

Smyrna, Smyrna, 1910.—North of Smyrna, in a suburb called Bairakh, in southeast corner of a threshing field; near two olive trees on northwest edge of rock-bordered path leading to the house of Vredos Petroklilos, 18 meters west of the more northerly tree, 5 meters north of the southerly one, and 21.5 meters west of a large almond tree on east side of road; marked by a soft white stone about 3 by 6 by 18 inches (8 by 15 by 46 cm.) sunk flush with ground and covered over with earth, and marked "C.I.1910," the exact point being the period after the C.

Tadmor (Palmyra), Syria, 1910.—On plain southwest of the upper ruins of the ancient city of Palmyra (Syrian name Tadmor). Near the western edge of the arable land along the southern edge of the plain are four small knolls; the observations were made between the second and third knolls. The station is 112 paces northwest of the northeast corner of the mud wall inclosing crops, and 96 paces northeast of northwest

ASIA.

TURKISH EMPIRE—*concluded.*

Tadmor (Palmyra), Syria, 1910—*continued.*
corner of same wall; marked by tent peg driven flush with ground and covered with earth.

Tchaouchdjikeuy, Konia, 1910.—Northeast and to rear of railroad station, on west bank of a small stream; about 4 meters from edge of stream, and marked by tent peg driven flush with ground. The ornament on northeast gable of main building of railroad station is in true bearing 126° 54′.0.

Tebook, Hejaz, 1910.—About one and one-fourth miles (2 kilometers) southeast from village of Tebook, on a plain southeast of the quarantine station, 136 paces northwest of center of earth bank around refuse pit, 182 paces east of east corner of hospital, and 233 paces south of flagpole at east corner of main building of quarantine station. There is a railroad between the station and the quarantine station, and a spur track runs from the main line to the quarantine station. The station is marked by tent peg driven flush with ground and covered with earth. The top of flagpole at east corner of main building of quarantine station is in true azimuth 175° 40′.5.

Tekrit, Bagdad, 1910.—On the small pear-shaped plateau which rises from the plain southeast of the town and has its small end abutting on the river; 49.4 meters west of south corner of a small stone hut, 40.1 meters southwest of center tree of three fig trees northwest of the hut, and 37.4 meters south of small lone mulberry tree; marked by a tent peg driven flush with ground and covered with earth.

Trebizond, Trebizond, 1909.—The main and secondary stations are on the northern edge of the little plateau near the lower end of the Pyxitis valley. The main station is near the eastern tip of the plateau, 50 and 22 paces respectively from the edges southeast and northeast. The flagpole on Battery Point north of the town bears 137° 56′.7. The secondary station is 265 feet (81 meters) 42° 03′.3 west of north of main station. Azimuths from the secondary station were determined as follows: mosque on summit of Boz Tepe, 100° 48′.1; lighthouse, 138° 08′.9. A third station was established on the seashore about 0.5 mile (0.8 kilometer) north-northwest of main station, about 150 yards (137 meters) west of slaughter house and 20 yards (18 meters) from water's edge. The flagpole on custom house bears 133° 23′.4.

Ummerdjim, Aleppo, 1910.—On the plain northwest of railroad station at Ummerdjim, on Damascus-Aleppo Railroad, between Homs and Aleppo; 248 paces northwest of west side of railroad station and marked by tent peg driven flush with ground and covered with earth. The top of southwest chimney of railroad station is in true bearing 310° 40′.0.

Ushak, Brusa, 1910.—North of railroad station of Ushak and south of the village, in a meadow belonging to the government; about 87 paces west of a branch road which leads from main road northwest to village, on a triangular plot of ground bordered on the northern and western sides by cultivated fields and on the south by a shallow ditch; the northern and western boundaries are well defined by a sudden rising of ground. The station is 36 meters northeast of southwest corner of triangle, 20 meters southwest of northeast corner of the triangle, and 9.5 meters southeast of northwest corner of triangle; marked by round tent peg about 1 inch (3 cm.) in diameter driven flush with ground and covered with earth.

AUSTRALASIA.

AUSTRALIA.

Melbourne, Victoria, 1906.—Observations were made on north and south piers of absolute house of magnetic observatory.

Red Hill, New South Wales, 1906.—Observations were made at the absolute house of Red Hill magnetic observatory branch of the Sydney Observatory, at Pennant Hill, about 8 miles (13 kilometers) from Sydney.

NEW ZEALAND.

Auckland, North Island, 1906.—Station is on highest point of the Domain, Auckland, in vicinity of Transit of Venus Pier; 98.9 feet (30.16 meters) from the pier and marked by the point of an arrow cut in top of limestone post 6 inches (15 cm.) square buried below the ground. The following true bearings were determined: finial on church steeple, Kyber Pass Road, 76° 11′.7; Transit of Venus pier, 335° 44′.8.

Christchurch, South Island, 1906, 1907–8.—The magnetic observations of 1906 were made at three stations, viz., east and west piers of absolute house of Christchurch Magnetic Observatory, and at a point designated as *Peg II*, in the observatory grounds, 40 feet (12 meters) northeast of the absolute house; the observatory is in the botanical gardens. The observations of 1907–8 were made at absolute house of observatory. Secondary stations, designated as *brass pipe, peg A*, and *near brass pipe*, were also occupied. The first is about 150 feet (46 meters) southeast of absolute house; the second is about 40 feet (12 meters) south of absolute house; the third is somewhat west-northwest of *brass pipe*.

New Brighton Beach, South Island, 1908.—Station is about 1,500 yards (1.4 kilometers) south of the recreation pier; on the beach just above high water, about 24 paces from edge of vegetation, between the sandhills and the sea. The point was roughly marked subsequently by a post 4 by 4 inches by 8 feet (12 by 12 cm. by 2.4 meters). The lighthouse is in true bearing 323° 15′.1.

EUROPE.

AUSTRIA-HUNGARY.

Pola, Trieste, 1910.—The observations were all made on the main pier in the absolute house of Pola Magnetic Observatory.

GERMANY.

Potsdam, Brandenburg, 1910.—Observations were made on pier No. 5 of Potsdam Magnetic Observatory.

GREAT BRITAIN.

Falmouth, England, 1909.—The main station, A, is on the flat forming Trefusis Point; 14 paces from the bank above the rocky beach, and 41 paces from the more southerly of the football goal-posts. The following true bearings were determined: center of St. Anthony's lighthouse tower, 308° 50′.0; main flagpole on Pendennis Castle, 339° 52′.0; church spire on hilltop, 43° 29′.3. A secondary station, B, was also established on the line joining the principal station with the center of St. Anthony's lighthouse tower produced northwestwardly 21 paces to a point about 24 paces from edge of hill.

Falmouth Observatory, England, 1909.—Observations were made at the Falmouth Observatory on a brick pier in the hut used for absolute observations. A stone set up on opposite hillside was used as a mark. This is the permanent reference mark of the Observatory and is in true bearing 4° 40′.7.

EUROPE.

GREAT BRITAIN—*concluded.*

Kew Observatory, England, 1908, 1910.—Observations were made on middle pier of new absolute house south of main building. The azimuth mark used was the monument north of observatory. Simultaneous observations for intensity, declination, and dip were made with observatory instruments in old absolute house.

St. Anthony, England, 1909.—Southwest of government signal station, and southeast of fort on St. Anthony's Point, within but near edge of a field; in a depression so low that only top of the signal can be seen and about 20 paces eastwardly of point where the fence that bounds the field deflects toward water's edge.

EUROPEAN RUSSIA.

Alexandropol, Erivan, 1908.—The point occupied by Assafrey in 1887 was recovered, but was not immediately available, owing to the proximity of some building stones and telegraph wires. Observations were made at a point (not far from the 1887 station) 170 feet (51.8 meters) from the bridge Mkehiants and about 100 feet (30 meters) from the gulch, on ground reserved for military operations. The line of building stones is distant east 18 paces, south 10 paces, west 32 paces. The following true bearings were determined: spire of church at Fort, 112° 08′.8; spire of Armenian church "Surp Nishan," 256° 47′.5; spire of Armenian church "Surp Pirkich," 306° 32′.3; spire of old cemetery church, 356° 47′.8. A secondary station was established between the main station and the Fort, 550 feet (168 meters) from main station and in line with main station and spire of Surp Pirkich.

Baku, Baku, 1909.—Stations located in southwest corner of navy yard on south side of harbor, very near site of Rykatchew's observations of 1881. The main station is 111 feet (34 meters) from south wall of yard, and 149 feet (45 meters) from west wall. The following true bearings were determined: water tower on hill west of city, 145° 12′.6; left minaret of two similar minarets, seen to the left of Cathedral spire, 164° 12′.3; Cathedral spire, 164° 55′.6; right minaret of two similar minarets, seen to the right of Cathedral spire, 167° 02′.1; lighthouse known as the "Tower of the Virgin," ancient Tartar monument (point sighted on was window in little house on top of tower), 172° 50′.7; belfry spire on Harbor Church, 342° 03′.6; fire tower in the city about two miles (3.2 kilometers) or more distant, 180° 06′.2. Secondary observations were made at a point 92 feet (28 meters) 0° 06′.2 east of north of main station.

Batum, Kutais, 1908, 1909.—The stations of 1908 and 1909 are practically identical, being on the beach beyond the Boulevard Garden and very nearly at spot occupied by Smirnoff in 1906, about 150 feet (45.7 meters) from the sea, about 400 yards (366 meters) from new cathedral to the east, and 135.5 feet (41.3 meters) from middle of guard-house towards the sea. The spire of gymnasium, distant about one-third mile (0.5 kilometer), is in true bearing 50° 11′.4. A secondary station was established 92.5 feet (28.2 meters) northeast of main station in line with main station and spire on gymnasium.

Elisavetpol, Elisavetpol, 1909.—Near the station of Assafrey, 1890; almost due north of church in Russian Cemetery north of city, in line with east wall of cemetery, 91 paces north-northwest of northeast corner of cemetery wall, and 45 paces from edge of little ravine which starts in churchyard and runs northwest past station. The following true bearings were determined: church spire in town seen just to

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EUROPEAN RUSSIA—*continued.*

Elisavetpol, Elisavetpol, 1909—*continued.*
the left of northeast corner of churchyard, 326° 57′.8; northeast corner of churchyard, 328° 45′; spire of cemetery church, 359° 28′.3; northwest corner of churchyard, 35° 38′.

Erivan, Erivan, 1908.—Apparently the same point as that occupied by Assafrey in 1887; south of town on the flat above east bank of Sanga River, and 66½ feet (20.3 meters) from wall bounding cemetery on the north, measured from a point 188 feet (57.3 meters) from end of wall on river bank. The ground is extremely hard sun-baked clay mixed with small black volcanic stones, which affect the magnetic needle when brought close. The following true bearings were determined: spire of church south of cemetery, distant 0.5 km., 3° 15′.8; cathedral spire, distant 2 km., 209° 29′.0. A secondary station was established 216 feet (65.8 meters) north of main station in line with it and the spire of church south of cemetery.

Jevat, Baku, 1909.—Near the station of Assafrey of 1890, probably somewhat to northwestward of his station. From the ferry across river below the union of the Kura and Araxes rivers a road follows the right bank of latter to the village of Kalakoiney. Between the road and river is a levee which branches into two levees at a point a little over 300 meters above the point where the Araxes makes a sharp turn to the westward, a short distance above its junction with the Kura. The station is in this fork of the levees, 75 paces from river bank, 21 paces from levee nearest river, and 40 paces from fork of the levees. The dome spire of the Russian Church bears 140° 42′.2.

Karsani (*Tiflis Observatory*), *Tiflis*, 1908, 1909.—The observations of 1908 were made at two stations, viz.; on the north pier of absolute house of Tiflis Magnetic Observatory, designated as A, and on a pier, designated as P, some 350 yards (320 meters) east of and below absolute house. In 1909 the two stations of 1908 were reoccupied and also a third station, designated as O; the last station is outside the absolute house, about 50 feet (15 meters) northeast of main pier.

Nakhitchevan, Erivan, 1908.—This station is very nearly the same as that of 1888; on the brow of a mud hill in the midst of a cluster of Turkish graves, almost unrecognizable as such, about 150 yards (137 meters) from road leading northward from the town, and about 100 yards (91 meters) from some mud houses to the southeast. To the westward of station the ground descends rapidly to the broad plain of the Araxes. Observations were made at a secondary station about 150 yards (137 meters) nearly due north of main station, across a little valley.

Orenburg, Orenburg, 1909.—The stations of 1909 are probably not far from the points occupied by Tillo, Scharnhorst, Ovodov, and J. Smirnov, in 1870, 1871, 1872, and 1873, and subsequently by D. Smirnov. Station A is one-fourth mile (0.4 kilometer) east of the bridge for vehicles, near east end of a small woods, 30 feet (9 meters) south of bank of a long pond or arm of Ural River (a narrow park separates pond from river). The right-hand and lower spire of the red brick church, 1 kilometer distant, seen between the woods and west end of pond, bears 144° 11′.9. Station B was established 137 feet (42 meters) southeast of main station in continuation of azimuth line from red brick church.

Petrovsk, Daghestan, 1909.—Observations were made in the open level square 0.5 mile (0.8 kilometer) or more southeast of lighthouse, near station of Rykatchew and Smirnov of 1881 and 1906. The point is 44 paces from the street on the southeast side of square, 300 feet (91 meters) from a stone wall northeast, and about 400 feet (122 meters) due south of the new gymnasium for girls which is in range between the station and the Armenian Church. The following true bearings were determined: spire on conical roof on waterworks building, seen to the right of lighthouse, 133° 06′.4; lighthouse, 130° 51′.6; belfry of the Russian Church, 155° 52′.2.

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EUROPEAN RUSSIA—*concluded.*

Petrovsk, Daghestan, 1909—*continued.*

Samara, Samara, 1909.—In a large open field near Anisimov Garden, 135 paces from post road to Melekes and 60 paces southwest of wooden fence around garden, probably a short distance northwest of D. Smirnov's station of 1906. The following true bearings were determined: dome of seminary in city, 88° 45′.2; left flagstaff on hippodrome, 320° 27′.6; right spire of Peter-Paul's Church, 69° 27′.5; belfry spire of the Cathedral, 74° 56′.0; Monastery dome, 113° 27′.7.

Ufa, Ufa, 1909.—Station A is on the hillside about 350 paces from the Serjevskie Church, the spire of which is visible over shoulder of hill. The point is probably as much as 500 feet or 150 meters south of Smirnov's station of 1904. The following true bearings were determined: belfry spire of Iljinskaia Church, 126° 25′.3; water tower, 116° 16′.8; dome of conspicuous white church, 121° 02′.4; dome of conspicuous red church, 141° 43′.1; red church north of city, 174° 32′.1; cross on Serjevskie Church, 203° 49′.3. Station B was established 385 feet (117 meters) 53° 34′.7 west of north of station A on ground about 30 feet (9 meters) lower than the latter.

Yenotaevsk, Astrakhan, 1909.—On the shoulder of a low rise in the desert west of town. The following true bearings were determined: large monument or vault in cemetery north of town, 254° 50′.8; belfry spire of church in northern part of town, 261° 13′.7; belfry spire of church in south central part of town, 306° 00′.2; fire tower, 308° 37′.6.

TURKISH EMPIRE.

Adrianople, Adrianople, 1910.—North of city, in a municipal park on an island in Tunja River, southwest of park-keeper's house and an octagonal kiosk built of stone. The river makes a horseshoe bend on the eastern side of the island; the kiosk is at north end of bend and the station at the south end, 207 paces southwest of kiosk, 42 meters north of a willow overhanging river, 57 meters east of a large tree, 55 meters southeast of a large beech tree, and 43 paces south of center of road to kiosk. The station is marked by tent peg driven flush with ground. The following true bearings were determined: east minaret of Sultan Selim Mosque, 8° 55′.1; north minaret, 10° 03′.4; west minaret, 11° 13′.7.

Rumeli Hissar, Constantinople, 1908, 1909, 1910.—The stations are on the grounds of Robert College, on the European shore of the Bosporus, about 6 miles (9.5 kilometers) above Constantinople. The general locality is about 250 feet (76 meters) above the water, on the side of a hill rising 150 feet (46 meters) higher; there is an outcropping of granite about 75 feet (23 meters) above the stations. The stations of 1908 and 1909 are identical, being 52.5 feet (16.3 meters) from a stone wall to southeast, and 100 feet (30.5 meters) from wall northeast. In 1910, the station marker having been removed, two new stations were established and designated as *A* and *B*. Station *A* is on a flat shoulder of the hill, about 50 feet (15

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TURKISH EMPIRE—*concluded.*

Rumeli Hissar, Constantinople, 1908, 1909, 1910—*cont.* meters) north and 15 feet (5 meters) west of former station. Station *B* is 88.5 feet (27.0 meters) south, 84°.5 west of station *A*. In 1908 a secondary station was established on the line from main station to kiosk at Amant Keni.

Rumeli Hissar, Hill Station, 1909.—On hilltop back of Robert College, north of the little grove of 18 cedars, on a nearly level grass plot covering top of the hill; 74 feet (22.6 meters) from southeast corner of an old wooden shed west of station, and 55.5 feet (16.9 meters) from nearest tree of second row of cedars counting from the east; marked by wooden tent peg driven nearly flush with ground. The minaret of a mosque at Vani Keni bears 346° 08′.9. The minaret of the mosque back of Skutari is almost due south of station.

Tcherkeskioi, Adrianople, 1910.—In a meadow on the north bank of a small stream about one-quarter mile (0.4 kilometer) north of railroad station; 50 paces north of center of a road on north bank of the stream, about 70 paces northeast of ford by which the road on south bank crosses the stream and joins the road on north bank, 7.6 meters east of a spring, and 30.3 meters east of an unknown tree which is in line with the spring. The station is marked by round tent peg driven flush with ground. The following true bearings were determined: tall white minaret in Tcherkeskioi, 115° 22′.0; west gable of main part of railroad station, 350° 37′.9.

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Abitibi Crossing, Ontario, 1909.—In the clearing just west of Hudson's Bay Company's store, about 20 paces from southwest corner of store, 25 paces north of railroad embankment, and about 15 feet (5 meters) from ditch excavated in making the railroad embankment. The flagpole of the Hudson's Bay Company bears 243° 55′.0.

Abitibi Lake, Quebec, 1909.—On the hill on Hudson's Bay Company's reserve, in the corner formed by fences around the garden and the burying ground; 18 feet (5.5 meters) from the east or garden fence, 24 feet (7.3 meters) from the north fence, and about 20 feet (6 meters) north of a foot-path running along top of hill to Company's store; marked by 2-inch (5 cm.) stake driven flush with ground. The following true bearings were determined: French Company's flagpole across the Bay, 333° 43′.8; Hudson's Bay Company's flagpole, 56° 03′.6; pole on church spire, 73° 01′.8.

Agincourt, Ontario, 1906.—Observations were made on the regular intensity and dip piers of Magnetic Observatory of the Meteorological Service of Canada, at an auxiliary station just outside the building. As there was no appreciable station difference found, the results are all given under the designation Agincourt, Magnetic Observatory.

Algoma, Ontario, 1906.—In field south of Grand Central Hotel, about 500 feet (152 meters) northwest of Canadian Pacific Railway track and the same distance southwest of depot; 144.5 feet (44.0 meters) south of the Grand Central Hotel and 11 feet (3.4 meters) east of line of back of main part of the hotel produced. The tip on water tank of Canadian Pacific Railway is in true bearing 265° 29′.1.

Antoine's Bay, Saskatchewan, 1908.—Near a small bay at end of a long island in Reindeer Lake, just before the big open crossing to Porcupine Point. The white

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CANADA—*continued.*

Antoine's Bay, Saskatchewan, 1908—*continued.* rocks of the Bay can be seen from far down the channel. The station is about 30 paces back from shore and is marked by spruce stake 2 inches (5 cm.) in diameter and 2½ feet (0.8 meter) long driven 1½ feet (0.5 meter) into the ground, and surrounded by a pile of stones.

Ashcroft, British Columbia, 1907.—In a field, owned by B. C. Express Company, in southern part of town; 100 feet (30.5 meters) east of bank of Thompson River, and about 1,000 feet (305 meters) from Canadian Pacific Railway track; marked by brass screw in top of fir post 3½ by 3½ by 30 inches (9 by 9 by 76 cm.) projecting 11 inches (28 cm.) above the ground. Declination observations were also made at a point 58 paces distant in line with spire of Presbyterian church. The following true bearings were determined: Presbyterian church spire, 179° 42′.2; Methodist church spire, 194° 36′.4.

Badger, Manitoba, 1906.—In a field northeast of section house of Canadian Northern Railway, and about 550 feet (168 meters) from railroad track.

Banff, Alberta, 1907.—Three stations designated as Park, Sulphur Mountain, and Tunnel Mountain were occupied. The first is in grounds of National Park Museum, 292 feet (89 meters) south-southwest of southwest corner of museum building; 67½ feet (20.6 meters) from northeast corner of duck pen and 93½ feet (28.5 meters) from southeast corner of duck pen, about 10 feet (3 meters) north of bank of river, and about in line with west side of one-story building in rear of C.P.R.R. Museum on north bank of Bow River; marked by round stake driven flush with ground. The following true bearings were determined: Meteorological Observatory (middle of anemometer pole) on Sulphur Mountain, 8° 07′.2; bottom of flagstaff of east tower of observatory of Sanitarium Hotel, 332° 40′.8. The Sulphur Mountain station is about 50 yards (46 meters) west of Dominion Meteorological Observatory and about 25 yards (23 meters) lower (this being the only place in vicinity of observatory free from possible disturbing influences), about 3 feet (1 meter) west of path as it turns in going up to observatory on west side and in path leading down along ridge of mountain. The Tunnel Mountain station is on the highest point overlooking village of Banff; 43 feet (13.1 meters) from a cairn of stones marking summit, with a rock standing upright in middle, in general direction of Meteorological Observatory on Sulphur Mountain.

Baskatong, Quebec, 1906.—In southeast corner of village church grounds, south of Baskatong Bridge; 100 feet (30.5 meters) southeast of southeast corner of church, 30 feet (9.1 meters) from wire fence east of the lot and 15.5 feet (4.7 meters) from fence on the south; marked by pine post 5 by 5 by 16 inches (13 by 13 by 40 cm.) driven flush with ground. The cross of church is in true bearing 107° 58′.0.

Battleford, Saskatchewan, 1908.—The station established by Canadian observer in 1907 was reoccupied. It is in an open field on property of Royal Northwest Mounted Police, west of buildings, about in line with north side of roughcast dwelling to east, and post near fence on west; west fence distant about 222 feet (68 meters) from station.

Berlin, Ontario, 1906.—About a mile (1.6 kilometers) west of town, on the Petersburg road, in a pasture belonging to Mr. Shafer and across road from his house; 122 feet and 153 feet (37.2 and 46.6 meters) from south and east pasture fences respectively.

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CANADA—*continued.*

Big Opatook, Quebec, 1910.—About 5 miles (8 kilometers) above the "Narrows" on east shore of Lake Mistassini, just where the shore line changes its course from north to northeast. There is a camping place up a steep bank about 20 feet (6 meters) high and the station is in a small clearing 75 feet (23 meters) south of this, and approximately 100 feet (30 meters) west from lake shore. A stake showing 2 inches (5 cm.) above ground marks exact spot.

Biscotasing, Ontario, 1906.—About 800 feet (244 meters) southwest of Canadian Pacific Railway station; back of Catholic Church, on a rocky knoll 80 feet (24.4 meters) from nearest corner and nearly in line with east side of church. The following true bearings were determined: spire on Episcopal Church, 303° 14′.5; cupola on schoolhouse, 87° 04′.0.

Black Point, Nova Scotia, 1905.—In yard of Black Point House and about 630 feet (192 meters) east of house used for variometer observations during eclipse of August 30, 1905; 169.4 feet (51.6 meters) from east corner of Black Point House, 60.7 feet (18.5 meters) from flagpole, 84.8 feet (25.8 meters) from summer house, and 95.8 feet (29.2 meters) from top of boulder south of summer house, about 200 yards (183 meters) from shore, and about same distance from road. The Cransben Island light is in true bearing 304° 25′.1.

Brandon, Manitoba, 1906.—In a field north of Canadian Pacific Railway, and west of Sixth Street, about one-third mile (0.5 kilometer) from the former and about 50 paces from the latter. The following true bearings were determined: spire on Catholic Church, 344° 40′.8; flag pole on post office, 30° 15′.8; highest spire on Insane Asylum, 206° 16′.0.

Broadview, Saskatchewan, 1906.—In a field southwest of town; in line with fence on south side of Catholic Church yard and 81 feet (24.7 meters) west of southwest corner of yard. The following true bearings were determined: tip on Canadian Pacific water tank 204° 31′.4; southeast corner of west abutment of Canadian Pacific Railway bridge 146° 07′.3.

Calgary, Alberta, 1908.—Observations were made at station established by Canadian observer in 1907, in grounds of Royal Northwest Mounted Police. It is almost in line with south side of Seventh Avenue, 120 feet (36.6 meters) east of fence line, and about 97 feet (30 meters) northwest of northwest corner of fence around garden of superintendent; marked by a 3-inch (8 cm.) post projecting 2 inches (5 cm.) above ground. The following true bearings were determined: apex of left tower of Baptist Church on 7th Ave., 94° 54′.1; spire on Baptist Church, 93° 58′.4.

Canoe Limit, Northwest Territories, 1908.—Near place where canoes are left behind when voyageurs are going farther north, travel being overland from this point, as the nearest lake is distant about 30 miles (48 kilometers). Observations were made on east bank of most northern bay of a very large lake about 10 miles (16 kilometers) long east and west by 6 miles (10 kilometers) wide, thickly dotted with islands. The station is about 60 paces back from shore on a sandy spruce-covered hill, with numerous large stones embedded about; marked by 5-inch (13 cm.) tamarack post 2 feet (0.6 meter) long, projecting 10 inches (25 cm.) above ground, surrounded by three spruce stakes and six tent peg stubs.

Chalk River, Quebec, 1906.—Near northwest extremity of a hill northwest of Copp's Hotel, in line between rod on water tank near railway depot and two poplar trees which stand in a small gully northwest from

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CANADA—*continued.*

Chalk River, Quebec, 1906—*continued.*
station. Middle one of three poplar trees is 42 feet (12.8 meters) distant to northwest and the south fence is 185 feet (56 meters) distant measured along crest of hill. The station is marked by pine stake 2 inches (5 cm.) in diameter and about 14 inches (36 cm.) long. The following true bearings were determined: spire on Catholic Church, 52° 31′.0; bottom of staff on water tank at railway station, 325° 30′.0; bottom of staff on water tank about one mile west of railway station, 191° 09′.3.

Chapleau, Ontario, 1906.—Near river bank on east side of town, just at end of street lying between Protestant and Catholic cemeteries; 60 feet (18.3 meters) southeast of southeast corner of Protestant Cemetery, and 59 feet (18.0 meters) northeast of northeast corner of Catholic Cemetery. The pole on the Algoma Hotel is in true bearing 72° 33′.9.

Charlottetown, Prince Edward Island, 1908.—Observations were made over stone marking north end of true meridian line established by the British Admiralty in Victoria Park. The stone is 14 by 13 inches (36 by 33 cm.) and projects 18 inches (46 cm.) above surface. A triangle is formed by north and south meridian stones and a third stone to west. The precise point of observation was over east end of groove about 2 inches (5 cm.) long in southwest quarter of the stone. The following true bearings were determined: tip of ornament on city hospital, 250° 08′.6; church spire, 234° 49′.4; church spire seen between two chimneys, 229° 55′.0; south meridian stone, 00° 10′.9.

Chatham, Ontario, 1906.—On the circus grounds about one-fourth mile (0.4 kilometer) southeast of Grand Trunk Railway depot; 183 feet (55.8 meters) from fence along road to northeast, and 164 feet (50.0 meters) from fence bounding field on northwest.

Chibougaman, Quebec, 1909.—On top of small ridge just to right of route from Mistassini to Point Bleue, at entrance to Chibougaman Lake, near north end; 35 yards (32 meters) from both the southeast and southwest shores and marked by hole drilled in rock below moss.

Chicoutimi, Quebec, 1906.—Near southern end of athletic grounds belonging to Catholic Seminary and near a large flat white rock level with surface; 24 feet (7.3 meters) north of row of poplar trees at southern end of grounds, 139.4 feet (42.5 meters) east of west fence along road, 94 feet (28.7 meters) from east row of poplar trees, and 11.5 feet (3.5 meters) from flat white rock in line between Cathedral spire and rock produced. The following true bearings were determined: spire on St. Anne Catholic Church, 128° 31′.4; Chicoutimi Cathedral, 163° 25′.1; top of Price Monument, 221° 49′.1.

Craft Island, Baffin Land, 1908.—On an uncharted and hitherto unnamed island. The name Craft Island was given by Captain Bartlett of the *Erik.* Observations were made on a small plateau on eastern slope of very high steep mountain with two needle-shaped peaks.

Cumberland House, Saskatchewan, 1908.—Probably very near the old stations, as the Hudson's Bay Company's post is on an island and the point selected is the best place for making observations; on the open knoll facing Cumberland Lake to north, about 125 paces west of Hudson's Bay Company's store, and nearly in line with southeast corner of store and northwest corner of Mr. Haight's house. The Hudson's Bay

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CANADA—*continued.*

Cumberland House, Saskatchewan, 1908—*continued.* Company's flagpole is seen directly over center of large warehouse. The station is the intersection of a cross cut in top of flat stone set flush with ground. The following true azimuths were determined: Catholic Church spire, 346° 55′.8; flagpole of Hudson's Bay Company, 315° 58′.6; Franklin's sundial, 309° 40′.4.

Cumberland Sound, Baffin Land, 1908.—The instrument was set up in an alcove formed by rocks on beach of island west of anchorage and east of a small fresh-water lake.

Dauphin, Manitoba, 1908.—In south corner of public school grounds, near intersection of Second Street and Second Avenue, 50 feet (15.2 meters) from south-east and southwest fences; marked by post driven flush with ground. The steeple on Presbyterian Church bears 149° 31′.9.

Dawson, Yukon Territory, 1907.—On a tract of government land in rear of administration building, approximately one-half mile (800 meters) north of Klondike River, about 300 feet (92 meters) southeast of administration building, about 200 feet (61 meters) nearly due south from astronomical pier of 1907, about 88 feet (27 meters) south of a roadway little used running from Sixth Avenue toward Fifth Avenue, and 62 feet (19.0 meters) west from boardwalk along Sixth Avenue. Marked by an oak post 6 by 8 by 36 inches (15 by 20 by 91 cm.) set with its top flush with ground, the precise point being shown by a small brass screw. The following true bearings were determined: flagstaff on ferry tower, 174° 38′.4; flagstaff on courthouse, 92° 57′.1.

Deer's Lake, Saskatchewan, 1908.—On Hudson's Bay Company's reserve at Deer Lake Post, at south end of Reindeer Lake, on east bank of river and on hill to north of Hudson's Bay Company's store; marked by a hole drilled in piece of white granite about 6 by 15 inches (15 by 38 cm.) lying with long edge north and south. The southeast corner of French Company's house is in true bearing 213° 49′.6.

Eagle River, Ontario, 1906.—In a field about 25° east of magnetic south from Canadian Pacific Railway depot and distant from it about 500 feet (152 meters), about 60 paces southeast from southeast corner of Central Hotel.

Edmonton, Alberta, 1908.—In grounds of Royal Northwest Mounted Police, at Canadian station of 1907, about 150 feet (46 meters) north of street fence and about 53 feet (16 meters) west-southwest of southwest corner of stable; marked by stake driven flush with ground. The following true bearings were determined: apex of water tower in Strathcona, 22° 23′.9; flagpole of Strathcona school, 14° 38′.8.

Edmundston, New Brunswick, 1906.—Two stations designated as A and B were occupied. Station A is in northwest corner of lot around public schoolhouse; 20.9 feet (6.4 meters) from a wooden rail fence along the north, 20.1 feet (6.1 meters) from wooden fence along the west, and 116.8 feet (35.6 meters) from northwest corner of schoolhouse; marked by wooden post 1.5 by 3 by 15 inches (4 by 8 by 38 cm.) driven flush with ground. The bottom of cross on spire of Catholic Church is in true bearing 38° 47′.0. Station B is in a large lot west of schoolhouse and in line with Station A and cross on Catholic Church spire; 84 paces from Station A, 82 paces from wooden fence toward church spire and 60 paces from wooden fence near road to south.

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CANADA—*continued.*

Emsdale, Ontario, 1906.—In a pasture just east of Grand Trunk Railway station, near summit of small knoll; 122 feet (37.2 meters) and 97 feet (29.6 meters) from rail fences on south and east respectively.

Englehart, Ontario, 1906, 1909.—The station of 1906 was about 90 meters south of the hotel and near middle of two intersecting street clearings. In 1909 it could not be reoccupied on account of traffic and the proximity of buildings. A new station was established about one square practically due south of the old, in clearing at end of street running south from depot, just beyond the block on which is the Methodist Church, and three blocks south from street running east and west by depot. An ornament on gable between two chimneys on depot bears 181° 01′.2.

Estevan, Saskatchewan, 1906.—In field west of town, in line with south gable of Estevan Lumber Company's elevator and a pole on Dr. Davis's Block and about 220 paces from Canadian Pacific Railway. The following true bearings were determined: pole on Dr. Davis's Block, 289° 26′.6; pole on Empire Hotel, 293° 39′.4; spire on Methodist Church, 320° 05.′3; pole on schoolhouse, 343° 39′.0.

Farrington, Ontario, 1906.—About 350 feet (107 meters) north of Canadian Northern Railway track, about opposite section house.

File Axe Lake, Quebec, 1910.—At southeast end of the portage over height of land near shore of File Axe Lake; 15 feet (4.6 meters) from shore line, and 9 feet (2.7 meters) northeast of the portage trail; marked by a stake showing about 1 inch (2 cm.) above ground.

Fort Selkirk, Yukon Territory, 1907.—On low ridge south of government telegraph station and about 300 feet (91 meters) south 21° west (true) from the astronomical pier erected in 1907; marked by wooden post 2 by 3 by 29 inches (5 by 8 by 74 cm.) projecting about 5 inches (12 cm.) above surface. The precise point is indicated by the head of a brass screw set in the top. The following true bearings were determined: flagstaff on Hotel Francais, 120° 25′.4; cross on Catholic church spire, 121° 48′.2; flagstaff on telegraph station, 193° 50′.0.

Fort William, Ontario, 1906.—Approximately one of the stations occupied by L. A. Bauer for the United States Coast and Geodetic Survey in 1903; 81 paces north of north boundary of Leith Street nearly in center line of Syndicate Avenue produced, about 140 paces north-northwest of northwest corner of large brick schoolhouse, about 60 rods west of site of the old fort, about one quarter mile (0.4 kilometer) west of Port Arthur Electric Railway and about 50 rods east of Canadian Northern Railway. The following true bearings were determined: cross on St. Joseph's Convent, 304° 53′.2; spire on town hall, 346° 57′.7.

Forty Mile, Yukon Territory, 1907.—Between custom house and barracks of the Northwest Mounted Police, about one-fourth mile (0.4 kilometer) south of confluence of the Forty Mile and Yukon Rivers, about 150 feet (46 meters) from west bank of latter; 80 feet (24.4 meters) south of custom house; marked by brass screw in top of wooden post 2 by 4 by 24 inches (5 by 10 by 61 cm.) projecting slightly above ground. The left edge at base of south chimney on North American Transportation Company's store is in true bearing, 140° 25′.7.

Frog Portage, Saskatchewan, 1908.—On south bank of Churchill River just east of Frog Rapids, about 15 paces from water's edge and same distance from portage path; to rear of station is large open space

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CANADA—*continued.*

Frog Portage, Saskatchewan, 1908—*continued.* used for camping ground; marked by 3-inch (8 cm.) poplar stake 2½ feet (0.8 meter) long, projecting 1 foot (0.3 meter) above ground.

Glacier, British Columbia, 1907.—On hotel grounds, in clearing east of buildings; about 400 feet (122 meters) from track of Canadian Pacific Railway, and about 250 feet (76 meters) from the Glacier House Annex; marked by head of brass screw in top of wooden peg, which is about 1½ by 1½ by 17 inches (4 by 4 by 43 cm.) projecting about 2 inches (5 cm.) above surface.

Gladstone, Manitoba, 1908.—Near fair grounds southeast of town, almost in line with fence on south side of street leading to main entrance to fair grounds and with fence on east side of street running north and south on east side of fair grounds; 66 feet (20.1 meters) south of fence corner across street, and 43.5 feet (13.26 meters) east of fence inclosing fair grounds; marked by small post driven flush with ground. The following true bearings were determined: flagpole on schoolhouse, 234° 22′.6; spire on Presbyterian Church, 241° 26′.9.

Goderich, Ontario, 1906.—About one-third mile (0.5 kilometer) north of Grand Trunk Railway station and 239 feet (72.9 meters) west of fence bordering railway on west, on a piece of land known as the "common"; 315 feet (96.0 meters) north of a fence along south side of "common." The tip on depot tower is in true bearing 343° 44′.1.

Grindstone River, Quebec, 1910.—25 paces east of small tributary of Grindstone River and one-fifth mile (0.3 km.) from mouth of tributary, in first of camping places at beginning of the first of the "Deux Portages"; 14 feet (4.3 meters) north of portage path. A stake showing about 2 inches (5 cm.) above ground marks exact spot.

Halifax, Nova Scotia, 1905.—As the old station in the Admiralty Dockyard was not accessible, a new station was selected on Point Pleasant, about 2½ miles (4 kilometers) south from city, as near as possible to place occupied by Prof. Dixon in 1904. It is west of the fort in a small open place between the road and beach, and 65 feet (20 meters) from road. The lighthouse tower is in true bearing 306° 38′.5.

Hawkesbury, Quebec, 1906.—In field about one-fifth mile (0.3 kilometer) back of Hawkesbury Hotel and about one-fourth mile (0.4 kilometer) northwest of Grand Trunk depot.

Height of Land, Quebec, 1909.—On point of land on north side of small lake called by the Indians "Au che que she che wan," meaning "water flowing the other way"; about 60 feet (18 meters) from extreme point and about midway of east and west shores; marked by stake driven flush with ground.

Hudson Bay Junction, Saskatchewan, 1908.—In open space between Grand View Hotel and Canadian Northern Railroad tracks, being 50 feet (15.2 meters) from the hotel and 190 feet (57.9 meters) from the tracks; marked by 1½ inch (4 cm.) spruce stake 1½ feet (0.5 meter) long, projecting one inch (3 cm.) above ground.

Husky Portage, Northwest Territories, 1908.—At the beginning of the last portage before reaching the Lake of the Huskies, on a hill 30 feet (9 meters) high rising from river bank. The soil is sandy with a few large rocks embedded here and there. The observations were made over a cross mark chiseled in a 6 by 12 inch

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Husky Portage, Northwest Territories, 1908—*continued.* (15 by 30 cm.) stone projecting about 2 inches (5 cm.) above ground and about 15 feet (5 meters) back from edge of hill.

Husky Post, Northwest Territories, 1908.—At Hudson's Bay Company's reserve, on northwest bank of Gravel Ridge Lake, known as Husky Post or Fort Hall; about 35 paces back from edge of bluff and 40 feet 9 inches (12.42 meters) from northeast corner of new loghouse residence, and is marked by a 2½ inch (5 cm.) spruce stake projecting one foot (0.3 meter) above ground.

Hyde Park, Ontario, 1906.—On a small hill in a pasture about one-fourth mile (0.4 kilometer) southwest from the junction, 26 feet (7.9 meters) north of fence along north side of highway and 49 feet (14.9 meters) from west fence of pasture.

Ignace, Ontario, 1906.—In an open field southeast of Canadian Pacific Railway Company's roundhouse; near southeast corner of field, 53 feet (16.2 meters) from east fence, and 52 feet (15.8 meters) from south fence, about 600 feet (183 meters) from roundhouse and about 500 feet (152 meters) south of main track of railroad. The following true bearings were determined: pole on Ignace Hotel, 144° 32′.6; tip on Canadian Pacific water tank, 118° 38′.0.

International Boundary, Yukon Territory, 1907.—Station A is located on the boundary line near south bank of Yukon River. It is in line with two boundary monuments, a white monument on north bank of river, and a bronze monument erected in 1907 on south bank. The distance between these monuments is about 500 yards (460 meters), the station being at a point 61 feet (18.6 meters) south of the bronze or more southerly one. The station is marked by brass rifle shell lettered on the end "W.R.A.Co. 30–40" and driven into the top of a wooden post 2 by 4 by 24 inches (5 by 10 by 61 cm.). The post projects about 2 inches (5 cm.) above the general surface. The apex of the white monument was used as a mark and assumed to stand due north.

Station B is near what was said by those resident in the region to be Ogilvie's station of 1887; on a ledge on north bank of Yukon River, about 2 miles (3 kilometers) east of boundary; about 50 feet (15 meters) above the water, and about 50 feet (15 meters) north of a skeleton pyramid of spruce logs erected above a wooden stake, reported to be the site of Ogilvie's station. The new station is marked by a round wooden stake perhaps 2 inches (5 cm.) in diameter, projecting about 6 inches (15 cm.) above surface.

Island Rapids, Ontario, 1909.—On left bank of Abitibi River below the fourth island in the rapids; these rapids are not named but they are a few miles down stream from the fourth portage from New Post. The station is 55 feet (16.8 meters) from edge of bank, and 6 feet (1.8 meters) southwest from a large outcropping stone; marked by 0.8 inch (2 cm.) drill hole in a flinty stone.

Jack Fish Lake, Northwest Territories, 1908.—On flat grassy point at narrow part of Cochrane River, about 300 yards (274 meters) from its entrance into Jack Fish Lake or Lake Brochet; about 30 feet (9 meters) from water's edge on a sort of grassy plateau which is the only good camping ground near; marked by a 2 inch (5 cm.) spruce stake 2½ feet (0.8 meter) long projecting 1½ feet (0.5 meter) above ground and surrounded by pile of stones.

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Junction, Quebec, 1909.—On an island in the Rupert River, just above where it widens into a lake which forms the beginning of the lakes route to Nemaska; on ground commonly used for camping, about 10 feet (3 meters) from north shore line and 50 feet (15 meters) from west shore line; marked by a stake driven flush with ground. Other islands are a small one one-fourth mile (0.4 kilometer) long just west, and a large one north, separated by a narrow rocky channel from the island on which station is located.

Ka-ba-she Bowstek, Quebec, 1909.—In a small clearing on south side of Rupert River at beginning of downstream end of portage; about 18 feet (6 meters) from edge of water; marked by drill hole in top of stone covered with pile of stones.

Kamsack, Saskatchewan, 1908.—In a field in southwest part of town, about 300 feet (91 meters) south of railway station, 81 feet (24.7 meters) from fence toward depot, and 171 feet (52.1 meters) from southeast fence; marked by cross cut in top of post driven flush with ground. The following true bearings were determined: northwest corner of Windsor Hotel, 218° 43′.8; flagpole on Russell Hotel, 233° 39′.8; tip on railroad water tank, 309° 20′.9.

Kenora, Ontario, 1906.—On the west slope of a rocky knoll about one-fourth mile (0.4 kilometer) east of Central School and about 2 rods (10 meters) north of north side of East Third Street. The following true bearings were determined: Spire on Episcopal Church, 101° 53′.4; spire on Knox Church, 67° 24′.2; pole on Central School, 95° 15′.2; spire on Catholic Church, 105° 21′.4.

Kingston Junction, Ontario, 1906.—In a meadow north of Grand Trunk Railway, which curves sharply at this point, and about 400 feet (122 meters) north from railroad track. The cross on St. Mary's Cathedral is in true bearing 2° 26′.8.

Kinmount, Ontario, 1906.—On east side of summit of a hill about one-half mile (0.8 kilometer) east of village and northeast of schoolhouse. The staff on schoolhouse is in true bearing 51° 49′.7.

Kippewa Station, Quebec, 1906.—About one-fourth mile (0.4 kilometer) southeast of Kippewa House and about same from Canadian Pacific Railway station, near extreme point of land on south side of Gordon Creek; 14.0 feet (4.3 meters) east of a rock 5 by 10 feet (1.5 by 3.0 meters) in section and about 6 feet (1.8 meters) high; about 33 feet (10 meters) west of middle of highest shelf of rocks overlooking the water, and about 50 yards (46 meters) west of water's edge; marked by natural right angle cut in the rock, one side 18 inches (45 cm.) long, running approximately magnetic north and south, and the other 11 inches (28 cm.), the intersection being 5 inches (13 cm.) deep. The following true bearings were determined: east gable of Kippewa House, 107° 47′.0; south side of east chimney of Kippewa House, 107° 45′.9.

Kirkella, Manitoba, 1906.—In an open field southeast of the village; in line with west end of Episcopal Church and south of the southwest corner 116 feet (35.4 meters). The southwest corner of upper part of Elevator No. 27 is in true bearing 141° 38′.6.

Labelle, Quebec, 1906.—On hill immediately west of the Catholic Church and about one-fourth mile (0.4 kilometer) distant, near large white rocky ledge at top of hill and visible from the church; in a small depression 13.5 feet (4.1 meters) west of middle of ledge at top; a rock lies 3.1 feet (94 cm.) to west and one 1.5 feet (45 cm.) to north of station. The following true bearings were determined: taller spire on Catholic Church, 241° 08′.5; cross on convent cupola, 253° 59′.2.

Lac du Brochet, Northwest Territories, 1908.—On the Hudson's Bay Company's reserve, in open space between inclosures and bank of Reindeer Lake. The following distances were measured from the station: to south corner of Hudson's Bay Company's inclosure 68 feet 8.5 inches (20.95 meters), to east corner of residence at east corner of inclosure 139 feet 2 inches (42.42 meters), to northwest corner of Solomon Cook's house 103 feet 2 inches (31.44 meters). The base of cross on Catholic Church spire is in true bearing 46° 57′.0.

Lacombe, Alberta, 1908.—In the unfenced open prairie east of town; in line with north side of A. M. Campbell's warehouse, and 279 feet (85.0 meters) east of sidetrack, and also in line with the creamery and the near corner of stock yards; marked by 4 inch (10 cm.) post projecting slightly above ground. The following true bearings were determined: ornament on east gable of creamery, 241° 14′.5; pole on railroad water tank, 203° 12′.6.

Lake Edward, Quebec, 1906.—About 400 feet (122 meters) south of railway station of the Quebec and Lake St. John Railway in southeast corner of grounds around French Catholic Church; 74 paces from northeast corner of church, 17 paces from southeast corner of lot, about 14 paces from south rail fence and a like distance from fence along east side of grounds. The following true bearings were determined: tip over center gable, front of railroad station, 157° 07′.5; cross on Catholic Church, 101° 34′.4.

Lauder, Manitoba, 1906.—On eastern edge of town back of schoolhouse; in line with its west side and 114 feet (34.8 meters) northeast of northernmost corner of schoolhouse, and 148 feet (45.1 meters) east of east corner of Presbyterian Church. The following true bearings were determined: northeast corner at top of Scott's elevator, 99° 04′.7; Methodist Church spire, 14° 01′.9.

Little Lakes Portage, Ontario, 1909.—In small clearing used for camping place at river end of a 1½ mile (2 kilometer) portage to the first lake of the Little Lakes route around the rapids in Abitibi River; in southernmost spot used by campers for pitching tents, and 4 feet (1.2 meters) west of path; marked by a 2-inch (5 cm.) stake 24 inches (61 cm.) long driven flush with ground.

Little Loon Lake, Quebec, 1909.—In spruce grove on east side of lake, on ground usually used for camping, about 100 feet (30 meters) from lake shore to west and 50 feet (15 meters) from shore to south. It is marked by stake driven flush with ground.

Lloydminster, Alberta, 1908.—In northwest part of town, 375 feet (114.3 meters) south of railroad tracks measured at right angles from a point between freight depot and coal sheds; 69 feet (21.0 meters) from center of first street south of railroad, and 66 feet (20.1 meters) west of center of first street west of depot; marked by an oak post driven flush with ground. The following true bearings were determined: flagpole on schoolhouse, 62° 18′.5; church spire, 32° 37′.5; tip of city bell tower, 305° 53′.3.

Long Falls, Quebec, 1910.—A station was established in 1909 and reoccupied in 1910 as nearly as possible. The present point is located at upper end of the mile portage around Big Chaudiere Falls on the

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Long Falls, Quebec, 1910—*continued.*
Chamouchouan River, 25 paces west from the river in a small clearing; marked by a post 2 inches (5 cm.) in diameter projecting 2 inches (5 cm.) above ground, and lettered C.I.W. 1910.

McAdam Junction, New Brunswick, 1906.—In the woods north of Canadian Pacific Railway track, about one-sixth mile (0.3 kilometer) northwest of depot and near road running through woods.

Macleod, Alberta, 1908.—In southeast part of grounds of Royal Northwest Mounted Police barracks, west of town and north of railroad tracks; near main gate on east, and 96 feet (29.3 meters) from east fence; marked by small post driven flush with ground and covered with stones. The following true bearings were determined: railroad water tank, 63° 05′.2; spire of English Church, 237° 34′.8; spire of Presbyterian Church, 214° 15′.9.

Madawaska, Ontario, 1906.—About 120 yards (110 meters) south of Grand Trunk Railway and southeast of general store and post office; approximately 150 feet (46 meters) from southeast corner of store, and 350 feet (107 meters) from west gable of railway depot. The tip on the west gable of depot is in true bearing 204° 45′.7.

Maniwaki, Quebec, 1906.—On the public land approximately southwest of Laurentian Hotel, which is near Canadian Pacific depot; 50 feet (15.2 meters) south and 337 feet (102.7 meters) west of the latitude and longitude pier of the Dominion Government, which is near fence south of depot; marked by a wooden post about 2 inches (5 cm.) in diameter driven flush with ground. The cross on Catholic Church is in true bearing 218° 32′.1.

Marten Creek, Quebec, 1909.—On east bank of Marten Creek, just above the first rapids and portage after leaving Rupert River and 15 yards (14 meters) from edge of bank; marked by pile of stones.

Matheson, Ontario, 1909.—Observations were made at two points designated as A and B. Station A is on west side of town, at a point about 100 yards (91 meters) north of railroad track and 150 yards (137 meters) west of depot. The instruments were mounted on a tree stump about 15 inches (38 cm.) in diameter and about 42 inches (1.1 meters) above ground. Flagpole on Revillon Brothers' store bears 260° 38′.4. Station B is on top of bank of Black River about 60 yards (55 meters) east of a tramway used to carry freight from town to the boats and about 20 feet (6 meters) north of a road running at right angles to tramway for some distance along shore.

Mattawa, Ontario, 1908, 1909.—The Canadian station of 1907 was reoccupied in 1908 and 1909. It is on the west bank of Mattawa River near its junction with the Ottawa, in the Hudson's Bay Company's reserve. The station may be found by following Pembroke Street westwardly 722.0 feet (220.07 meters) from northwest corner of Pembroke and Water streets, and then following a line northwards making an angle of 102° 09′ with the first line 311.0 feet (94.79 meters); marked with a 3 inch (8 cm.) stake projecting slightly out of the ground and having a cross mark to indicate exact point. The following azimuths were determined: flagpole on schoolhouse across Mattawa River, 318° 24′.9; cross on right-hand spire of Catholic Church (with bells), 29° 26′.8.

Melfort, Saskatchewan, 1908.—In southwest part of town near northeast corner of fair grounds; 68 feet (20.7 meters) south of the north fence, 100 feet (30.5 meters) west of east fence, and 122 feet (37.2 meters) from northeast corner of frame exposition building; marked by post projecting 2 inches (5 cm.) above ground. The following true bearings were determined: near gable of western elevator, 242° 04′.1; flagpole on exposition building, 18° 46′.5.

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Melfort, Saskatchewan, 1908—*continued.*

Mishomis, Quebec, 1906.—In northeast corner of a meadow north of hotel, on north bank of the Gatineau River, 190 feet (58 meters) northwest of southwest edge of barn on the hill, 62 feet (18.9 meters) from barbed wire fence on east side of meadow, and 37 feet (11.3 meters) from barbed wire fence on north side; marked by pine post 5 by 5 by 18 inches (13 by 13 by 45 cm.) driven flush with ground. There is considerable local disturbance. The following true bearings were determined on prominent points on the hotel, which is about 500 feet (152 meters) distant: west edge of west chimney, 358° 29′.8; west edge of east chimney, 353° 35′.8; east gable of hotel, 353° 02′.9.

Missinaibie, Ontario, 1905, 1906.—The observations of 1905 and 1906 were made approximately at the same point. The station is nearly one-fourth mile (0.4 kilometer) west of the old Hudson's Bay Company's Post and about 400 feet (122 meters) south of railroad, in southeast corner of yard around Episcopal Church; 12.5 feet (3.8 meters) from wooden fence on east, and 27.5 feet (8.4 meters) from the one along south side of yard. The following true bearings were determined: tip on railway company's water tank, 155° 28′.6; pole on schoolhouse, 177° 09′.4. In 1905 a secondary station, designated as Eclipse station, was occupied at a short distance north-northeast of main station.

Misstassinny, Quebec, 1909.—In the clearing between the Hudson's Bay Company's store and the lake shore, almost in line with west end of store building extended; 60 feet (18.3 meters) from southwest corner of store, and 54 feet (16.5 meters) from northeast corner of the shop; marked by large stake driven flush with ground.

Mistassini, Quebec, 1906, 1909.—About one-fourth mile (0.4 kilometer) north of Trappist Monastery on top of first hill on road winding along Mistassini River; about 20 feet (6 meters) from south edge of hill and about same distance from west edge; marked by Father Paul of the Monastery by a wooden post 6 inches (15 cm.) in diameter and 24 inches (61 cm.) long, sunk flush with ground, with pieces of broken earthernware around the bottom. The following true bearings were determined: cross on church, 18° 43′.0; tip on Monastery tower, 358° 25′.5; west edge of chimney on flour mill, 0° 44′.0.

Mistassini Lake, Quebec, 1909.—On top of ridge extending east from main part of large wide island in Mistassini Lake, about two hours paddle from Rupert River. The island is west of the principal route across the lake to Mistassini and is commonly used for camping. The station is about 40 feet (12 meters) above high water, 75 feet (23 meters) from north shore, 100 yards (91 meters) from east shore, and 130 yards (119 meters) from shore of large bay to the south; marked by stake projecting about 2 inches (5 cm.) above ground.

Montreal, Quebec, 1906.—The U. S. Coast and Geodetic Survey station of 1905 was occupied, on the cricket and football field of McGill University, 148 feet (45.1 meters) from southeast corner of grand stand, 178.8 feet (54.5 meters) from northeast corner and about 130 feet (40 meters) from middle of road. The following true bearings were determined in 1905: flagpole on tower of Arts Building, 136° 55′.7; tip of

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Montreal, Quebec, 1906—*continued.*
tower of Presbyterian College, 93° 30′.2; north gable of lodge near entrance to grounds, 285° 31′.1; southwest corner (at ground) of Monson Building, 121° 37′.0.

Moose Factory, Ontario, 1909.—On lawn in front of a row of houses and shops facing and at top of slope of bank towards the Moose River; about 37 paces from flagpole, 65 feet (20 meters) from front line of house adjoining that of the Chief Factor, 30 feet (9 meters) from a skid used for drawing boats from the water into winter quarters, and nearly in the continuation of the line of east edge of the canoe landing. The following true bearings were determined: front gable of white house west of flagstaff, 54° 54′.2; ornament on belfry, 196° 49′.1.

Muskrat Lake, Quebec, 1910.—On southeast end of westernmost small prominent island between Muskrat and Loon lakes, a few miles towards the height of land from Lake Nikabou. The island is about 200 feet (61 meters) long. The station is in a small clearing, 10 paces from the water and 12 feet (3.7 meters) southeast by east of a large white birch; marked by small stake showing about 1 inch (2 cm.) above ground.

Nemaska, Quebec, 1909.—Near south shore of island occupied by the Hudson's Bay Company's trading post; 60 feet (18.3 meters) from northeast corner of manager's house and 25 feet (7.6 meters) from a large log frame used in sawing lumber; marked by cross cut in top of large stake driven flush with ground. The left edge of Hudson's Bay Company's flagpole bears 301° 59′.2.

Netting Place, Quebec, 1909.—On south side of a small island on north side of main route from Nemaskg to Mistassini, at what is known locally as the Nettina Place; this island is about 150 yards (137 meters) long and 75 yards (69 meters) wide, with a peninsula running out on north side and forming two bays. The station is in camping place northeast of where fires are built and about 35 feet (11 meters) from south side of island; marked by cross in top of spruce stake driven below surface of ground.

New Liskeord, Ontario, 1906, 1909.—The station of 1906 was in eastern corner of the grounds around the new public school (a concrete block building), in line with north side of building extended toward the Wabis River about 71 meters. In 1909 a new station was established as that of 1906, owing to proximity of wire fence and small houses, was no longer considered suitable. The new station is in line with west side of schoolhouse and 57 paces northwardly from northwest corner, and somewhat northwest of the old site; marked by intersection of two lines cut on top of brick sunk flush with ground. The following true bearings were determined: flagpole on "Canada" hotel, 293° 46′.2; church spire, 317° 05′.6.

New Post, Ontario, 1909.—On east bank of Abitibi River in northern part of the Hudson's Bay Company's reserve; 20 feet (6 meters) from large poplar tree at top of high bank of river, 15 feet (4.6 meters) from edge of bank, 70 feet (21 meters) from warehouse of the company to east-northeast, and about 125 feet (38 meters) from the Factor's dwelling to the southeast; marked by stake driven flush with ground.

Niantilik, Baffin Land, 1908.—The U. S. Coast and Geodetic Survey station of 1896 could not be located. A new station was established on a shelf between the rocks at extreme northeastern end of a low point of land on extreme southeastern part of island. At high water this point is connected with the mainland by a very narrow isthmus. The shelf is about a foot (0.3 meter) above high-water mark and just large enough to accommodate a tent. Station is marked by center of mouth of a quart bottle sunk flush with ground and covered by rocks.

Nipigon, Ontario, 1906.—In northeastern part of town, about 400 feet (122 meters) east of Canadian Pacific Railroad and within 4 paces of bank of Nipigon River; in line with fence along north side of a street running from the C. P. R. R. water tank eastward to river, and 30 feet (9.1 meters) from fence corner. The following true bearings were determined: spire on Canadian Pacific Railroad water tank, 89° 37′.1; spire on Episcopal Church, 36° 24′.4.

North Bay, Ontario, 1906, 1909.—The observations of 1906 and 1909 were made at very nearly the same point. The station is on street running east from Canadian Pacific Railway depot, northeast from new public school building, on a vacant lot owned by the city and reserved for school purposes; about 36, 46, and 28 meters respectively from the west, east, and south lines of the depot property; marked by 1-inch stake driven flush with ground. The following true bearings were determined: mast of wireless telegraph station, 161° 01′.9; the flagpole on old schoolhouse, 25° 00′.9.

Norway House, Northwest Territories, 1907.—Klotz's station of 1884 was described as being "to the west of post and upstream." Station A was located according to this description, about 50 yards (46 meters) inland from a little point on the east bank of Nelson River, and about one-fourth mile (0.4 kilometer) above or south of the post; marked by brass screw in top of wooden post, 4 by 4 by 24 inches (10 by 10 by 61 cm.), projecting about 4 inches (10 cm.) above the surface. The following true bearings were determined: apex of Belanger monument, 195° 15′.5; flagpole near the monument, 195° 37′.2; magnetic station, Norway House, station B, 226° 51′.9.

Station B is on a ledge in rear of Hudson's Bay Post; about one-fourth mile (0.4 kilometer) northeast of Station A, and about 200 yards (183 meters) south of Belanger monument; temporarily marked by small poplar stake. The following true bearings were determined: magnetic station A, 46° 51′.9; apex of Belanger monument, 132° 30′.6; magnetic station C, 206° 45′.9.

Station C is in the open field northeast of post, about one-fourth mile (0.4 kilometer) from Belanger monument and approximately the same distance from station B; marked by small spruce stake. The following true bearings were determined: magnetic station B, 26° 45′.9; apex of Belanger monument, 64° 27′.3.

Oak Point, Manitoba, 1908.—In meadow between village and lake shore; 61.5 feet (18.7 meters) south of southwest corner of wire fence around Mr. A. Pritchard's yard, and 75 feet (22.9 meters) from southeast corner; marked by 2-inch (5 cm.) post driven flush with ground. The following true bearings were determined: gable of stable to south-southeast, 348° 25′.4; flagpole in yard of A. Pritchard, 225° 18′.0.

Ottawa, Ontario, 1906.—Near east corner of grounds of Astronomical Observatory, 81 feet (24.7 meters) from northeast fence and 53 feet (16.2 meters) from southeast; approximately 300 feet (91 meters) east of the corner of the observatory and marked by a pine

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Ottawa, Ontario, 1906—*continued.*
stake 2 by 4 inches (5 by 10 cm.) driven flush with ground. The flagstaff on tower of the House of Parliament is in true bearing 196° 55′.8.

Owen Sound, Ontario, 1906.—On fair grounds, about a mile (1.6 kilometers) northwest of Canadian Pacific Railway depot and south of principal building, between race track and bluff; 155 feet (47.2 meters) south of building, near line of west side produced, and 65 feet (19.8 meters) west of outer fence around race track.

Pelican Narrows, Saskatchewan, 1908.—On hill east of Hudson's Bay Company's store and about 7 paces northeast of flagpole in direct line with ice house, residence, and office building; marked by a 2-inch (5 cm.) birch post 2 feet (0.6 meter) long projecting 6 inches (15 cm.) above ground and surrounded with stones; the following true azimuths were determined: Catholic Church spire, center of upright on cross, 91° 31′.6; center corner on flagpole, 44° 49′.5; southwest corner of French Company's store, 300° 26′.2.

Penetanguishene, Ontario, 1906.—In a small pasture, about one-fourth mile (0.4 kilometer) east of railway station; 114.5 feet (34.9 meters) from south fence of pasture, 184 feet (56.1 meters) from the west fence, and 32 feet (9.8 meters) and 34 feet (10.4 meters) respectively from two old apple trees, the first nearly west and the second north from station. The following true bearings were determined: flagstaff on bank building, 40° 16′.4; west edge of cross on Catholic Church, 30° 39′.3.

Peribonka, Quebec, 1906.—On right bank of Peribonka River, about midway between steamer wharf and house occupied by the colonization agent.

Peterborough, Ontario, 1906.—About a mile (1.6 kilometers) west of city, on tract of ground belonging to Mr. Mahary, and about 107 feet (33 meters) south of south side of road, which is a continuation of Charlotte Street; 71 feet (21.6 meters) from fence on west.

Portage Lake, Quebec, 1909.—On north shore of lake, about 150 yards (137 meters) from water, on flat clearing between the spruce timber and fringe of high bushes near shore, and directly north of shallow bay formed by a rocky point of land covered with standing dead spruce trees.

Prince Albert, Saskatchewan, 1908.—The station of 1907 in the open ground of the Hudson's Bay Company's reserve was relocated only approximately, on a prominence overlooking the city from southeast. This location is almost directly south of the Exhibition building and about three-eighths mile (0.6 kilometer) east of west boundary of the Hudson's Bay Company's property and almost on a line with the continuation of Ninth Street. The peak of the prominence is about 150 feet in diameter, covered with grass and bushes. The station is marked by cross cut in top of post 4 by 4 by 30 inches (10 cm. by 10 cm. by 76 cm.) projecting 8 inches (20 cm.) out of ground. The following true bearings were determined: tip on city water tower, 81° 24′.0; flagpole on Exhibition building, 331° 33′.2; smokestack on Hudson's Bay Company's mill, 313° 04′.3; north stack on lumber mill, 289° 11′.0.

Quebec, Quebec, 1906, 1909.—The U. S. Coast and Geodetic Survey station of 1905 was reoccupied in 1906 and 1909. It is on the "Plains of Abraham" in the portion formerly used as a race course in line with rear wall of jail, also in line with north corner of jail and a church spire, and is 168.4 feet (51.33 meters)

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Quebec, Quebec, 1906, 1909—*continued.*
from boundary stone at intersection of two fences; marked by a 2½ inch (6 cm.) stake driven flush with ground in middle of a depression about 3.5 feet (1.1 meters) in diameter. The following true bearings were determined: church spire, 321° 29′.3; church spire, 27° 52′.9.

Quill Lake, Saskatchewan, 1908.—In open field southeast of town, just east of lacrosse field, on south side of railroad track; 76 feet (23.2 meters) east of east goal of lacrosse field, 162 feet (49.4 meters) south from elevated platform used for loading grain, and 7½ feet (2.29 meters) west from a red boulder about 2 by 2 by 1½ feet (0.6 by 0.6 by 0.5 meter) in size; marked by small stake driven flush with surface. Point of belfry on schoolhouse bears 91° 03′.3.

Rainy River, Ontario, 1906.—On western side of town and about 600 feet (183 meters) south of main track of Canadian Pacific Railway; in lot lying between first and second streets running south of and parallel to railway, and west of street crossing these and passing cold storage house of Gordon, Ironside, and Fares; 199 feet (60.6 meters) west of fence along east side of this street, and about 63 feet (19 meters) north of center line of street on south. The following true bearings were determined: flagpole on schoolhouse, 276° 20′.4; pole on McQuarrie and Grimshaw's Block, 279° 34′.0.

Red Rock, Ontario, 1909.—On right bank of Abitibi River, north of a bank about 20 feet high covered with forest recently burned over; 14 feet (4.3 meters) from edge of river bank and 50 feet (15 meters) below bend in river. Directly across river is a high-water island, near lower end of which is a large red rock in the river near left bank, known locally as Red Rock, and about a mile below station; marked by a small stake covered with a pile of stones.

Regina, Saskatchewan, 1906.—On open ground on southeast edge of city, in the southwestern angle formed by Victoria and Ottawa Streets, about 20 paces south of center of Victoria Street and 19 paces west of center of Ottawa Street. The following true bearings were determined: pole on Alexandra School, 104° 02′.2; pole on Windsor Hotel, 144° 59′.2; spire on Roumanian Church, 164° 50′.9.

Renfrew, Ontario, 1906.—Near middle of a meadow situated north of Canadian Pacific Railway station and separated from it by a private roadway and a row of dwellings; approximately 300 feet (91 meters) from fence on west of meadow and the same distance from that on the east; about 320 feet (98 meters) from fence on north of meadow, and about 168 feet (51 meters) from a fence corner at the head of a ravine toward the northwest. The following true bearings were determined: tip on water tower, 31° 37′.5; cross on Catholic Church, 2° 00′.3.

Riviere du Loup Point, Quebec, 1906.—F. E. Hilgard's station of 1876, for lack of description, could not be located. Present station is on point near steamer wharf, probably about 3 or 4 miles (5 to 6 kilometers) west of Hilgard's station, on government grounds at a point in line between the government flagpole and the spire on St. Patrick's Church in Riviere du Loup. The flagpole is 178 feet (54.3 meters) distant to west-northwest, the east thin wire fence is 36 feet (11.0 meters), and the south fence is 107 feet (32.6 meters) distant. The station is marked by a wooden post about 2 by 3 by 24 inches (5 by 8 by 60 cm.) driven flush with ground. The following true bearings were determined: spire on St. Patrick's

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Riviere du Loup Point, Quebec, 1906—*continued.*
Church, 299° 44′.5; spire on St. Ludgère, 307° 41′.1; lighthouse on wharf, 64° 30′.6; government flagpole, 119° 51′.6.

Roberval, Quebec, 1906.—On the shore of Lake St. John about 300 feet (91 meters) east of the Commercial Hotel, in the line of the north side of the hotel extended toward the lake. This line strikes across several flat rocks, one of which has a sharp corner on the north side; this point marks the station. The following true bearings were determined: cross on Catholic Church, 136° 37′.8; west edge of hotel, 79° 04′.0.

Rupert's House, Ontario, 1909.—In a field east of the buildings of the Hudson's Bay Company's post, within a few yards of the station of 1890 of W. Ogilvie. The 1909 station is about 50 feet (15 meters) from fence on side toward Rupert River, 50 paces from fence toward buildings, 79 paces from stable, and in range of Hudson's Bay Company's flagpole and nearest building of the French Company; marked by cross in top of 4-inch (10 cm.) stake driven flush with ground. The following true bearings were determined: Hudson's Bay Company's flagpole, 79° 44′.2; rod carrying weather vane on church spire, 70°08′.0.

St. Alphonse, Quebec, 1906.—In front of McLean's Hotel, about 100 feet above the village and on a large granite rock, separated by a cleft about 2 feet wide from main granite cliff at east edge of hotel grounds; in line with northeast corner of hotel and spire of Catholic Church and about in middle of the rock, 6.5 feet (2.0 meters) from east edge of rock and about 6 feet (1.8 meters) from narrow cleft to west, measured along line joining northeast corner of hotel and spire of Catholic Church. The spire on Catholic Church is in true bearing 275° 07′.3.

St. Jerome, Quebec, 1906.—In an open field one-third mile (0.5 kilometer) east of Canadian Pacific depot. There is a sand bank to the southwest, a field of rocks on the west, and a wooded tract to the east. It is marked by a small hole in center of a shallow circular depression in surface of ground about 6 feet (2 meters) in diameter and about 30 feet (9 meters) south of two large granite blocks which project above the ground. The flagpole on the cupola of the brick hotel is in true bearing 88° 12′.0.

St. John, New Brunswick, 1905, 1909.—The stations of 1905 and 1909 are identical within a few feet. Observations were made on east end of high rocky hill west of railroad station, on northwest side of city, about 300 yards (274 meters) north of the old fort, and about 150 feet (46 meters) from the street skirting side of hill. The following true bearings were determined: Trinity Church spire, 310° 08′.8; Cathedral spire, 271° 34′.2.

Sandy Island, Quebec, 1909.—On northeastern edge of a large island covered with thin growth of spruce and pine brush and heavy carpet of moss, in Rupert River, about 2 miles (3 km.) above a large stone having a 2-inch (5 cm.) hole on one side near the top, and which is well known to the Indians in connection with their folk-lore. The station is about 15 feet (5 meters) above level of river and 65 feet (20 meters) from edge of low water; marked by stake covered with pile of stones.

Saskatoon, Saskatchewan, 1908.—Northeast of principal part of city, on bluffs across river, about one-fourth mile (0.4 kilometer) upstream from Canadian Pacific Railroad bridge, about 15 feet (5 meters) from edge

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CANADA—*continued.*

Saskatoon, Saskatchewan, 1908—*continued.*
of promontory between two ravines; marked by birch post 2 inches (5 cm.) in diameter projecting 3 inches (8 cm.) above ground. The following true bearings were determined: flagpole on Saskatoon Brewery, 44° 03′.4; flagpole on Plannigan Hotel, 58° 05′.8.

Savanne, Ontario, 1906.—Near the Savanne River, about a quarter of a mile (0.4 kilometer) south of Canadian Pacific Railway track; about 18 paces from north bank of river in a path which leads south from railroad, leaving railroad at a point about 800 feet (250 meters) east of depot. The line joining the pole on the Hudson's Bay Company's store with station passes about 2 feet (0.6 meter) west of a telegraph pole by the railroad. The pole on the Hudson's Bay Company's store is in true bearing 204° 28′.7.

Schreiber, Ontario, 1906.—In an open field about one-third mile (0.5 kilometer) east of town near cemetery and one-quarter mile (0.4 kilometer) from railroad; 100 feet (30.5 meters) from southwest corner and directly in line with picket fence on south side. The following true bearings were determined: spire on Presbyterian Church, 77° 55′.3; tip on railroad water tank, 358° 23′.7.

Scoop'em Rapids, Saskatchewan, 1908.—On east bank of Pine River, just above Scoop'em Rapids and about 8 paces back from river bank; marked by 6-inch (15 cm.) birch post 4 feet (1.2 meters) long, projecting 1.5 feet (0.5 meter) above ground.

Simcoe, Ontario, 1906.—Near sand pit, in small field about one-fourth mile (0.4 kilometer) southeast of the Wabash depot; 42 feet and 77 feet (12.8 and 23.5 meters) from west and east fences respectively, and about 30 feet (9 meters) north of edge of sand pit.

Singed Marten Creek, Ontario, 1909.—On the south side of Singed Marten Creek, 50 paces from mouth, 12 paces from edge of creek bank, and directly in path leading from canoe landing to hole in ground used for building camp fires. Two white poplar trees stand 5 paces northeast and 3 paces southwest, the station being 4 feet (1.2 meters) southeast of a line joining these two trees. The point is marked by a 4-inch (10 cm.) stake projecting a foot (0.3 meter) above ground.

Spruce Rock, Saskatchewan, 1908.—On northeast corner of first island that is covered with moss and a thick growth of medium-sized spruce trees, off Burntwood Point to northeast; 16 paces from shore and marked by a cross chiseled in solid rock, over which is a pile of large stones.

Stewart, Yukon Territory, 1907.—On Stewart Island in rear of Stewart River House, about three-fourths mile (1.2 kilometers) north of the confluence of the Yukon and Stewart rivers; about 400 feet (122 meters) east of bank of Yukon River; marked by center of a wooden post, 2 by 4 by 24 inches (5 by 10 by 61 cm.), set so as to project about 4 inches (10 cm.) above ground. The lowest visible point on the flagstaff in front of the police barracks is in true bearing 133° 54′.2.

Sturgeon Tent, Saskatchewan, 1908.—At the camping ground on east bank of Sturgeon River, this being near the first place where large rocks are to be found, a number of them forming the opposite bank; marked by 4-inch (10 cm.) poplar post 5 feet (1.5 meters) long projecting 2½ feet (0.8 meter) above ground. The post is about 14 paces back from the river bank, on rising slope near three or four small clumps of spruce.

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CANADA—*continued.*

Sudbury, Ontario, 1906.—In northeast corner of jail yard, 193 feet (58.8 meters) from northeast corner of jail, 84 feet (25.6 meters) from board fence along the east, and 126 feet (38.4 meters) to board fence along north side of yard. The following true bearings were determined: spire on Catholic Separate School, 232° 14′.9; spire on Catholic Church, 249° 21′.5; pole on water tower, 301° 38′.8.

Swabmooswan, Quebec, 1909.—On north bank of river flowing into Swabmooswan Lake from direction of Height of Land, at a point where river makes an abrupt turn to south for one-fourth mile (0.4 kilometer) and then turns again to the east; 50 feet (15.2 meters) north of edge of bank and 50 yards (46 meters) west of a small creek which empties into the river; marked by cross in top of 4 inch (10 cm.) post projecting somewhat above ground.

Swan River, Saskatchewan, 1908.—East of town, near center of west side of the athletic park; almost due south of the west goal of lacrosse field, 24 feet (7.3 meters) east of fence inclosing race track, and 120 feet (36.6 meters) south of center of driveway between main entrance and clubhouse; marked by small post driven flush with ground. The following true bearings were determined: flagpole on schoolhouse, 105° 37′.5; flagpole on clubhouse, 232° 25′.2.

Sydney, Nova Scotia, 1905, 1908, 1909.—The stations of 1881 and 1896, established by the U. S. Coast and Geodetic Survey, having been found no longer available because of the growth of the city, a new station was established in 1905; this point was reoccupied in 1908 and again in 1909. It is about one-quarter mile (0.4 kilometer) removed from the first station and on the highest point of ground in the western portion of Victoria Park, northwest of business section, about one mile (1.6 kilometers) south of the iron foundries; about 85 paces north of a large willow tree, about 100 paces south of steel signal tower, and 12 feet (3.7 meters) east of a line joining them; marked by a drill hole at center of top of a stone marker set flush with ground. The following true bearings were determined: spire seen over iron works 209° 14′.3; north spire Catholic Church, 305° 41′.6; spire of an old stone church on esplanade, 327° 40′.7; tip on jail tower, 317° 32′.3. A secondary station was occupied in 1905 in the northeast corner of the cemetery of the English Church, on an unused portion of ground 28 feet (8.5 meters) from north fence and 28 feet (8.5 meters) from east fence. It is probably within 80 feet (24 meters) of Very's station (U. S. C. & G. S.) of 1881. The spire on the Catholic Church is in true bearing 73° 11′.2.

Tantalus, Yukon Territory, 1907.—In a clearing in front of the Northwest Mounted Police post about one-half mile (0.8 kilometer) below the Tantalus coal mine; about one-fourth mile (0.4 kilometer) above roadhouse known as Carmack's Post, and about 50 feet (15 meters) south of bank of Lewes River; 60 feet (18.3 meters) east of flagpole, and 128 feet (39.0 meters) south 78° east (true) from the astronomical pier erected in 1907; marked by a brass screw in top of wooden post 4 by 4 by 24 inches (10 by 10 by 61 cm.) projecting slightly above ground.

The Narrows, Ontario, 1909.—On south shore of narrows connecting east and west parts of Lake Abitibi, on point of land forming one shore of a small bay used as canoe landing. The station is 10 feet (3.0 meters) northeast of an iron rod surrounded by a pile of stones; marked by 2-inch (5 cm.) stake driven flush with ground.

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CANADA—*continued.*

The Pas, Northwest Territories, 1908.—In yard of mission residence, on island about one-eighth mile (0.2 kilometer) down the Saskatchewan River from the Church of England, and 100 feet (30 meters) from mainland; marked by a tamarack post 9 inches (23 cm.) in diameter projecting 2 feet 4 inches (0.7 meter) above ground. A piece of oak 2 inches (5 cm.) thick and 12 inches (30 cm.) square is fastened to top of a post by four wooden pegs; on top of this the sundial of Sir John Franklin was mounted after it had been tested and found to be absolutely non-magnetic. A cross filed in the gnomon of the sundial marks the magnetic station. A meridian line is marked by brass tacks in two large spruce posts set north and south of the magnetic station. The flagpole on schoolhouse and government building is in true bearing 2° 05′.7.

The Pas, Northwest Territories (*Lefroy's Station*), 1908.—Lefroy's station was reoccupied as nearly as it could be from his description. It is on the north fork of the Saskatchewan River, about 4 miles (6 kilometers) above The Pas at the "round turn" of the river or on the point where the river bends to the northward, on a low flat muddy bank covered with a growth of small willows; marked by a wooden stake 1½ by 1½ by 15 inches (4 by 4 by 38 cm.) projecting 1 inch (3 cm.) above ground.

Three Rivers, Quebec, 1906.—In front of the cemetery south of the "Convent of Precious Saints" situated on the hill about one-third mile (0.5 kilometer) southwest of Canadian Pacific Railway depot. At entrance to cemetery from east are two large grass plots inclosed by wooden fences, one on either side of roadway. The station is in the southern inclosure, 103 feet (31.4 meters) from its southwest corner, 82 feet (25.0 meters) from its southeast corner, and 52 feet (15.8 meters) from fence along road on east side. The cross on cathedral spire is in true bearing 90° 05′.4.

Timagami Inn, Ontario, 1906.—On Timagami Island, magnetically south of Timagami Inn about 75 paces. The flagpole on the hotel is in true bearing 165° 47′.8.

Timagami Station, Ontario, 1906.—On the first hill about one-third mile (0.5 kilometer) west of railway station, in middle of clearing made for a street and extending westward from depot. The west gable of the depot is in true bearing 269° 32′.9.

Timiskaming, Quebec, 1906.—In southeast corner of grounds about Bellevue Hotel at Timiskaming; about 15 yards (14 meters) north of stone wall along the south, about 30 yards (27 meters) west of stone wall along the east, and about 70 yards (64 meters) southeast of southeast corner of Recreation Hall of Hotel.

Twin Falls, Ontario, 1909.—On east side of Abitibi River, about 4 miles (6.4 kilometers) above mouth of Black River; 10 paces from edge of water, about 15 feet (5 meters) from portage path, and about even with the beginning of the first of the two falls; marked by cross cut in top of one of the many outcropping stones.

Twin Lake, Ontario, 1906.—On the site of the construction camp of Temiskaming and Northern Ontario Railroad about a mile (1.6 kilometers) north of Twin Lake; west of path leading down to brook which runs north of camp and 35 paces south of this brook; marked by pine stake 1 by 2 by 16 inches (2 by 5 by 40 cm.) driven flush with ground.

Two Rivers, Saskatchewan, 1908.—On east bank of Reindeer River on point that marks end of lake opposite Two Rivers; the stretch of sandy beach on the point is visible for a considerable distance down the river.

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CANADA—*continued.*

Two Rivers, Saskatchewan, 1908—*continued.*
The station is about 26 paces back from water's edge in an open level space with a dense growth of poplar and birch on rise back to east.

Victoria, British Columbia, 1907.—The station is very closely the same as that of the U. S. Coast and Geodetic Survey of 1903; on southeastern edge of city, about 500 feet (152 meters) in southwestwardly direction from flagpole in Dr. Millin's yard at Dallas Road and Dallas Ave., and 12 feet (3.7 meters) from edge of bluff overlooking beach, between Holland Point and Finlayson Point. The following true bearings were determined: Race Rocks Lighthouse, 43° 12′.5; flagstaff in Dr. Millin's yard, 244° 53′.1.

Wakonichi Lake, Quebec, 1910.—At southwest end of Wakonichi Lake, at end of long portage on regular route to Lake Mistassini; on slope of hill about 200 feet (61 meters) east of trail and 120 feet (37 meters) south from water's edge, on small level spot apparently used formerly as a camping place. A stake projecting 2 inches (5 cm.) above ground marks exact spot.

Warren's Landing, Northwest Territories, 1907.—In an open lot in rear of group of buildings near dock: about 50 yards (46 meters) east of track leading from old oil mill to dock; marked by a brass screw in top of a hewn wooden post 4 by 6 by 30 inches (10 by 15 by 76 cm.) projecting about 6 inches (15 cm.) above ground. The letters "C. 1. 1907" are carved on top. The apex of the new lighthouse across the river is in true bearing 18° 48′.0.

West Selkirk, Manitoba, 1907.—In the northern part of town on land reserved for the Manitoba Insane Asylum; about 400 yards (366 meters) north of asylum and about 270 yards (247 meters) northeast of stable; marked by a brass screw in top of wooden post 4 by 4 by 30 inches (10 by 10 by 76 cm.) projecting about 8 inches (20 cm.) above ground. The left corner of the asylum is in true bearing 355° 20′.9.

Whitehorse, Yukon Territory, 1907.—Near northwest corner of quadrangle formed by barracks of Northwest Mounted Police; 28 feet (8.5 meters) eastward from edge of walk bordered with white stones; 40 feet (12.2 meters) northeast of northeast corner of garden fence on west side of walk; about 55 feet (17 meters) north of tennis court, and about 75 feet (23 meters) from near edge of road to the north; marked by a wooden peg 2 by 2 by 24 inches (5 by 5 by 61 cm.) driven nearly even with the ground. The following true bearings were determined: right corner of barracks hospital, 91° 18′.2; base of cross on Catholic church spire, 181° 44′.0; base of flagstaff on post-office building, 250° 08′.9.

White River, Ontario, 1906.—In southeastern part of town back of schoolhouse, about 500 feet (152 meters) east of Canadian Pacific Railway track, and just a little north of summit of a small ridge running east and west; nearly in line of north side of schoolhouse, 18 paces back of a short board fence and 44 paces from southeast corner of main part of Methodist Church. The following true bearings were determined: tip on the Canadian Pacific Railway water tank, 128° 40′.6; spire on Catholic Church, 163° 35′.5.

Winnipeg, Manitoba, 1906, 1907, 1908.—In River Park, about half a mile (0.8 kilometer) east of park entrance, in the first cleared space beyond grove of small trees that surround entrance; about 15 paces from top of north bank of Red River and in line of fence bounding the buffalo pasture on side adjacent to river and about 330 feet (100 meters) southwest of south corner

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CANADA—*concluded.*

Winnipeg, Manitoba, 1906, 1907, 1908—*continued.*
of pasture. In 1908 the station was marked by a white marble post 4 by 4 by 24 inches (10 by 10 by 61 cm.) set about flush with ground; a small drill hole marks the exact point. The smokestack near International Elevator *C* is in true bearing 219° 18′.2.

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Acajutla, Salvador, 1909.—On a bluff overlooking the sea south of railroad station, 81 feet (25 meters) west of center of arc of breastworks to east, 60 feet (18 meters) east from small stump at center of arc of breastworks to west, and 17 feet (5.2 meters) from edge of cliff; marked by pine stake driven flush with ground. The following true bearings were determined: flagstaff at western corner of municipal building, 165° 18′.6; south gable of Mr. L. Brown's house, 171° 48′.7.

Amapala, Honduras, 1909.—Southeast of town, in an inclosed field belonging to Sr. Enrique Streber, on south side of Calle Carretaria; 78 paces south of south entrance to Sr. Streber's house, 47 paces south of large tree, and 89 paces eastwardly from a very large tree on west side of road to the west; marked by 2-inch (5 cm.) round stake driven flush with ground and covered with small stones. The following true bearings were determined: middle cross on church in Amapala, 156° 50′.4; cupola on offices and store of J. Rossner & Co., 155° 49′.1.

Ballena, Costa Rica, 1907.—At Ballena, the port of Bolson, which is about three-fourths mile (1.2 kilometers) to the south, on south bank of Rio Cañus, a tributary of the Tempisquito, and is reached by sailing vessel from Puntarenas; 27 feet (8.2 meters) from high-water line and marked by copper tack in oak stake.

Barranca Colorado, Panama, 1907.—On the higher of two knolls on west bank of river, northwest of landing; north of road leading to Sona, near summit of knoll, about 300 feet (91 meters) from wharf and 125 feet (38.1 meters) from west bank of river.

Belize, British Honduras, 1907, 1909.—On grounds of the governor's house, nearly due south 125 feet (38.1 meters) from flagstaff in front of house and 18 feet (5.5 meters) west of sea wall; 26.5 feet (8.1 meters), 11.5 feet (3.5 meters) and 84 feet (25.6 meters) from palm trees to northeast, east, and south respectively. The eastern boundary of the public Botanic Gardens is about 200 feet (61 meters) to west. The precise point is marked by a wood stake set flush with ground; it is probably very close to the station of 1879. The following true bearings were determined: steeple of St. Mary's Church (of England), 203° 59′.9; United Fruit Company's flagstaff at top, 203° 57′.4; light arm at Fort St. George, 237° 06′.2.

Bluefields, Nicaragua, 1909.—On a hill southeastwardly from custom house; 200 yards (183 meters) northwest of a cocoanut palm grove inclosed by wire fence, 97 feet (29.6 meters) southwest of entrance in wall of abandoned fort, about 36 feet (11 meters) northwest of junction of path from custom house with road to cocoanut grove, and about 9 feet (3 meters) from junction of custom house path with path to fortification; marked by pine stake driven flush with ground. The following true bearings were determined: west edge of lighthouse at top where it meets platform, 290° 46′.2; apex of light tower, 290° 42′.8.

Bocas del Toro, Panama, 1907.—In the Sand Fly Bay Cemetery, about three-fourths mile (1.2 kilometers) west of wharf; in line of two very conspicuous trees and a cocoanut tree to west of entrance; 75.1 feet

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CENTRAL AMERICA—*continued.*

Bocas del Toro, Panama, 1907—*continued.*
(22.89 meters) west of west corner of concrete wall around Ed. Clauzel's lot, 119.8 feet (36.52 meters) from iron cross center surmounting the monument of Manuela Frances K. de Lopez, and 75.0 feet (22.86 meters) from fence to the south, bounding the Chinese cemetery; marked by copper tack in top of oak stake, 1.5 by 1.5 by 30 inches (4 by 4 by 76 cm.) projecting about 2 inches (5 cm.) out of ground.

Cabulco, Guatemala, 1907.—In a lot which lies between the main north and south street which runs past rear of church, and the street next west which passes through plaza and in front of church, and just north of the fourth east and west street to north, beginning the count with the street passing south side of church; 34 feet (10.4 meters) from fence on north, 34.5 feet (10.52 meters) from fence on south, 46 feet (14.0 meters) from center of street on south, 27.8 feet (8.5 meters) from brush fence on west, and 37 feet (11.3 meters) from center of street on west. The highest point of front entrance tower of church is in true bearing 6° 36′.0.

Cape Gracias, Nicaragua, 1909.—In northeast part of town on a plain, midway between the main part of town and two large houses to northeast. It is 18.7 feet (5.7 meters) northwest of edge of marsh, 13.3 feet (4.0 meters) southeast of main boardwalk, and 66.7 feet (20.3 meters) northeast of lamp post at bend of main boardwalk; marked by pine stake driven flush with ground. The following true bearings were determined: flagstaff on commandant's office, 60° 12′.7; apex of light tower, 189° 05′.1.

Champerico, Guatemala, 1907.—At Chapan, a small salt works about three quarters mile (1.2 kilometers) northwest of Champerico across lagoon of salt water and within large plot of ground, with native houses on east, south, and west sides; 80.9 feet (24.66 meters) from northeast corner of a masonry house to south-southwest, measurement being taken from upper part of foundation; 83 feet (25.3 meters) from northwest foundation corner which bears 41° 31′ west of true south. The following true bearings were determined: staff on lookout tower just west of American Consul's house, 321° 47′.8; custom house flagstaff as seen on level of water tanks, 321° 16′.3; tower and flagstaff on office of Cia de Agencias de Champerico, Ltd., 322° 12′.8.

Chiche, Guatemala, 1907.—In a lot in northeast angle of intersection of street passing just south of plaza with third street east from plaza; 52.5 feet (16.0 meters) from brush fence on the north, 70.2 feet (21.4 meters) from west side of adobe wall to the east, 77 feet (23.5 meters) from brush fence to the south, and 33.5 feet (10.2 meters) from brush fence to the west. The following true bearings were determined: church entrance tower, 229° 13′.6; the cemetery entrance, 22° 19′.6.

Coban, Guatemala, 1907.—On the grounds of El Calvario; on a knoll overlooking city of Coban from northwest, about 120 feet (37 meters) southwest of chapel building, 75.3 feet (22.95 meters) from southwest corner of Francisco Paz monument, and 102.2 feet (31.15 meters) from base of wall on west side of steps leading down hill to entrance. The following true bearings were determined: apex of belfry tower of church, 304° 34′.4; lightning rod on square tower of German Club building, 350° 58′.9; rod on tower of chapel, at door, 253° 58′.0.

Colon Harbor, Canal Zone, 1907, 1908, 1909.—On west shore of Colon Harbor, about 3 miles (4.8 kilometers)

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Colon Harbor, Canal Zone, 1907, 1908, 1909—*continued.*
practically due west of former residence of M. de Lesseps, and about 20 feet (6 meters) west of high-water mark. The following true bearings were determined: first wireless telegraph mast, 255° 40′.8; west gable of De Lesseps house, 271° 03′.2; statue of Columbus, 271° 09′.0.

Colon, Quarantine, Canal Zone, 1909.—On east side of quarantine inclosure, between hotel and an iron-roofed shed, 77 feet (23.5 meters) from northeast corner of hotel and 73 feet (22.3 meters) from shed.

Corinto, Nicaragua, 1909.—Across bay from town of Corinto, on beach, southwest of house of Sr. J. J. Deshon, which is on bluff above and visible from Corinto; 62 paces southwest of small pier, 46 paces northwest of plank wall across small inlet; it is marked by 2-inch (5 cm.) round stake driven flush with ground. The following true bearings were determined: south gable of projection on center of Police Station in Corinto, 156° 12′.3; flagstaff at south end of Bodega in Corinto, 175° 24′.1; lightning rod on Sr. J. J. Deshon's house, 248° 12′.9.

Cristobal, Canal Zone, 1905, 1907.—The stations of 1905 and 1907 are practically identical. The station of 1907 is about 8 feet (2 meters) from high-water line and about 400 feet (122 meters) in a line 69° 23′.4 west of true north from north base triangulation station of the U. S. Coast and Geodetic Survey. The following true bearings were determined: north Marconi pole, wireless station, 200° 47′.0; south Marconi pole, wireless station, 202° 20′.5.

David, Panama, 1907.—On the grounds surrounding the Iglesia del Carmen, on north side of church, just northwest of town plaza; 139 feet (42.4 meters), 54.5 feet (16.61 meters), and 142.5 feet (43.43 meters) from the inner faces of the adobe fences to northwest, northeast, and southeast respectively; 98.9 feet (30.14 meters) from east corner of west side of side door of church, 81.2 feet (24.75 meters) from northwest corner of church, and 159.5 feet (48.62 meters) from east corner of east tower of church; marked by copper tack in an oak stub driven flush with ground. The following true bearings were determined: edge of east corner of Hotel del Istmo, 325° 01′.3; northeast corner of church at first course, 40° 05′.7; east corner of east tower of church, 338° 49′.2.

El Cayo, British Honduras, 1909.—East of village and about 200 yards (183 meters) west of river, near a grove on the plain. Three very large trees stand in a row northwest and southeast through middle of grove, at distances of 27.7, 57 and 98 feet (8.4, 17.4 and 29.9 meters) respectively northeast, north, and north-northwest from station. The point is marked by stake driven in the ground and covered with a thin block of wood, over which is a layer of earth. The flagpole in the mayor's yard was found in true bearing 353° 55′.4.

Flamenco Island, Canal Zone, 1907, 1909.—Near some old ruins on north side of island, and probably less than 50 feet (15 meters) distant from station of 1866; 58 feet (17.7 meters) south 24° west from center of an old brick sentry house, and may be located at low tide as being in line with easternmost point of Perico Island and Hotel Tivoli. The following true bearings were determined: tower and flagstaff, Hotel Tivoli, Panama, 155° 46′.8; tower Iglesia del Carmen, Panama, 159° 59′.7; northeast corner, at ground, of old part of fort at Panama, 163° 32′.2; tip of monument to men of U. S. S. *Lancaster,* Flamenco Island, 354° 46′.

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Flores, Guatemala, 1909.—On the shore of Laguna Petén, near beginning of trail to El Cayo and opposite street on island of Flores leading down from church; 53 feet (16.2 meters) west of lone tree northwest of landing, 35.5 feet (10.8 meters) south of shed, 32.5 feet (9.9 meters) south of large stone between shed and trail, 23 feet (7.0 meters) south of trail and 15.5 feet (4.7 meters) north of Laguna Petén; marked by stake driven in ground and covered with stone and layer of earth. The following true bearings were determined: church spire on island of Flores, 8° 12′.8; flagpole at center of barracks on island of Flores, 12° 05′.7; flagpole on west end of barracks on island of Flores, 14° 05′.2.

Golfo Dulce, Costa Rica, 1907.—In the plaza square, about 75 feet, 130 feet, 185 feet, and 165 feet (23, 40, 56, and 50 meters) from the rather indefinitely marked limits of the plaza to north-northwest, east-northeast, south-southeast, and west-southwest respectively. The flagpole in front of police quarters stands true north 28° 06′ west, 106.3 feet (32.40 meters), and a large wooden cross is true south 42° 34′ west, 188.8 feet (57.54 meters). The station is marked by copper tack in top of an oak stake 1.8 by 1.2 by 16 inches (4 by 3 by 40 cm.) driven flush with ground.

Granada, Nicaragua, 1909.—In the western part of town, north of Calle 5, southwest of the forks of the road, about 250 yards (229 meters) northwest of a masonry viaduct over a large ravine where road crosses into Calle 5; there is a large ravine between station and Calle 5. It is marked by a 2-inch (5 cm.) stake driven flush with ground. The following true bearings were determined: spire on hospital, 62° 56′.1; cross on Mercedes Church, 343° 45′.7; cross on San Francisco Church, 282° 15′.7.

Greytown, Nicaragua, 1909.—At foot of Calle Cuadra in east end of town, 106 paces north of north side of car line on Calle Real; 177.5 feet (54 meters) northeast of wild tamarind tree, 107 feet (33 meters) northeast of monkey bread tree, 36 feet (11 meters) southwest of custard apple tree, and 12 feet (4 meters) southeast of bank of Cano del Pueblo; marked by pine stake driven flush with ground. The north gable on Robert Herron's store on Calle Real is in true bearing 53° 07′.7.

Guatemala City, Guatemala, 1909.—In southeast end of grounds of El Fuerto Baños, at the southeastern extremity of Calle Oriente 10 and owned by Sr. Manuel Francisco Polanco, 112.2 feet (34.20 meters) southwardly from southwest corner of last building in southeast end of grounds, 113 feet (34.4 meters) from center column on south side of this building, 119.3 feet (36.36 meters) from southeast corner of this building, 119 feet (36 meters) east of most easterly tree on south side of main roadway, and 14 feet (4.3 meters) to south from center of roadway; marked by marble slab 2 by 4 by 18 inches (5 by 10 by 46 cm.) lettered C.1.1909, the period after the "C" being center of station. The following true bearings were determined: flagstaff over sally port of Fuerto de Matamoros, 220° 59′.2; flagstaff over projecting roof on front of Fuerto de Matamoros, 224° 17′.7; cupola on sentry box at extreme southern corner of wall of Fuerto de Matamoros, 233° 59′.4.

Huehuetenango, Guatemala, 1907.—On a knoll near the Temple of Minerva, to south of East Fifth Street, about one-half or three-fourths mile (1 kilometer) east of city building and plaza; about 1 foot (0.3 meter) southeast of prolongation of northeast and southwest diagonal of the Temple, 74.2 feet, 33.5 feet, and 73.9 feet (22.62, 10.21 and 22.53 meters) from northwest, southwest, and southeast corners of the lower foundation or steps of the Temple, respectively, and 70.5 feet, 42.6 feet, and 70.1 feet (21.49, 12.98, and 21.37 meters) from same corners measured to main floor or top steps. The following true bearings were determined: band stand flagstaff, at the roof, 190° 42′.9; hospital spire, 72° 22′.6; city building tower, 96° 58′.2.

Koschny (or San Carlos), Costa Rica, 1907.—On property of Mr. T. Koschny, on knoll 200 to 300 feet (61 to 91 meters) south of his residence; 98.8 feet (30.1 meters) from a 46-inch (1.2 meters) ojoche tree, about north 11° east, and 86 feet (26.2 meters) from a guava tree, which stands about south 5°.3 east from the station. A true south, as also a true west mark was fixed by iron nails in plum wood posts projecting 3.5 feet (1.1 meters) above ground, and distant 149.2 feet and 653.0 feet (45.48 and 199.03 meters) respectively. The station is marked by a tamarind post, 3 feet (0.9 meter) long and of oval cross section 5 by 6 inches (13 by 15 cm.) projecting about 1 foot (30 cm.) above ground. The following true bearing were determined: southeast gable of residence on La Sedina plantation of Kotelmann & Buwert, 158° 04′.9; north point of roof of T. Koschny's house, 182° 36′.0; apparent intersection of volcano Arenas and mountain to north, 95° 52′.3.

Laceiba, Honduras, 1907.—On grounds of Mr. Reynolds, M.D., in an open lot just back of his house; 20.8 feet (6.3 meters) from a 16-inch (41 cm.) plum tree at vertex of a right angle in the street, about 25 feet (8 meters) from right bank of a creek, and 50 feet (15.2 meters) from a very prominent ceiba tree on left bank. The following true bearings were determined: church tower, 140° 01′.0; northeast corner of American consul's residence, 25° 57′.4; square tower at center of General Pizzatti's house, 102° 46′.0; flagstaff at American Consulate, 35° 25′.8.

La Union, Salvador, 1909.—East of town on Punta de la Rabia, 106 paces northwest of mound in center of intrenchments, 112 feet (34 meters) northwest of the more northerly of two trees, and 125 feet (38 meters) northwest of more southerly, 163 feet (50 meters) northwest from large spreading tree on edge of bluff over sea and near trenches, and 59 feet (18 meters) southwest of a spreading tree growing laterally from the bluff; marked by tent peg driven flush with ground. The flagstaff at northeast corner of guardhouse on pier in La Union is in true bearing 126° 02′.6.

Macanché, Guatemala, 1909.—West of the village, on edge of trail to Flores, about 250 yards (229 meters) west of Macanché Laguna; 89, 80, and 79 feet (27.1, 24.4 and 24.1 meters) respectively from custard apple trees southwest, west, and northwest, and marked by round wooden stake covered by block of wood and layer of earth.

Managua, Nicaragua, 1909.—In western part of city, east of Calle 13, on land belonging to Sr. José Angel Aburta, and 72 paces southeast of corner of an unknown street to the north and Calle 13; marked by stake driven flush with ground. The following true bearings were determined: south gable of Napoleon Rey's house, 245° 21′.0; center of smokestack on electric plant, 214° 57′.4.

New Haven, British Honduras, 1907.—In a small settlement about 15 miles north-northeast of Punta Gorda, in an open space about 125 feet (38 meters) from shore

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CENTRAL AMERICA—*continued.*

New Haven, British Honduras, 1907—*continued.*
of bay, and 84.2 feet (25.66 meters) from southeast corner post of Methodist Chapel. The east edge of Wilson's Cay is in true bearing 8° 00′.0.

Perspire, Honduras, 1909.—East of town, at south end of a bow-shaped hill, in a meadow inclosed by a stone wall, on northeast corner of intersection of road leading from San Lorenzo to Tegucigalpa and that to Perspire; 57 paces northeast of northeast corner of house in the inclosure, and marked by 2-inch (5 cm.) round stake driven flush with ground and covered with earth and stones. The following true bearings were determined: spire on dome of church, 113° 08′.0; flagstaff at southwest corner of municipal building, 116° 54.′5.

Point Patuca, Honduras, 1909.—At northern end of native village, about 1.5 miles (2 km.) south of bar on west bank of Patuca River, between three native huts and a very small stream flowing into Patuca River; 34.5 feet (10.5 meters) south of small stream; marked by 2-inch (5 cm.) round stake driven flush with ground.

Port Burchard, Honduras, 1909.—In southern part of a rectangular field south of the Commandant's office; 77.5 feet (23.6 meters) southeast of a small orange tree, 74.5 feet (22.7 meters) east of a large orange tree, 73.5 feet (22.4 meters) northeast of a large trumpet tree, and about 250 paces from the southeast corner of Commandant's office; marked by pine stake driven flush with ground. The following true azimuths were determined: flagstaff on Commandant's office and guardhouse, 187° 32′.3; south gable of Commandant's office and guardhouse, 190° 27′.3.

Prinzapolca, Nicaragua, 1909.—At southern end of town on east bank of Prinzapolca River; 27 paces southeast of south end of crossing over small inlet of Prinzapolca River, and 10 paces east of a path leading south; marked by pine stake driven flush with ground. The following true bearings were determined: flagstaff on north gable of José Aramburn & Co's. store, 161° 33′.1; projection on east gable of Silverstein & Kelting's store, 179° 53′.9.

Puerto Barrios, Guatemala, 1909.—At northeast end of town on a small point of land running out into the sea; 28.7 feet (8.8 meters) southeast of a cocoa palm, 15 feet (4.6 meters) east of a cocoa palm, 28.7 feet (8.8 meters) northeast of a mango tree, 16.4 feet (5.0 meters) northwest of the southwest corner of the frame of church building, and 57 feet (17.4 meters) northwest of cocoa palm standing near entrance of building occupied by Chinese; marked by peg driven flush with ground. The following true bearings were determined: gable of bay window on north side of roof of Commandant's building, 35° 46′.3; flagstaff at northwest corner of Commandant's building, 36° 27′.9.

Puerto Cortez, Honduras, 1907.—About 250 yards (229 meters) west of United Fruit Company's wharf and about 110 feet (34 meters) from the shore line on north side of bay. The swamp is approximately 35 feet (11 meters) north of station. The east gable of custom house is in true bearing 273° 36′.5.

Punta Dominical, Costa Rica, 1907.—About 110 feet (34 meters) east of high water line somewhat south of the mouth of Rio Dominical and to the east of extreme northwest point of the promontory in the harbor, which becomes an island at high water; somewhat southeast of a small grove of cocoanut trees, about half-way between them and the base of a prominent

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CENTRAL AMERICA—*continued.*

Punta Dominical, Costa Rica, 1907—*continued.*
knoll partly cleared and under cultivation, and roughly in the line joining northwest end of promontory and point midway between the two extreme southern trees of the cocoanut grove.

Punta Gorda, British Honduras, 1907.—In north side of grounds of district commissioner's house; 49.5 feet (15.09 meters) east-southeast of flag and light mast, 13.8 feet (4.21 meters) from fence on the north, 41 feet (12.5 meters) from fence line on the east, about 45 feet (14 meters) from shore line eastward, and 58 feet (17.7 meters) from wattle fence to the west; approximately in line with the sea side of commissioner's house extended, and marked by a copper tack in wooden stake driven flush with ground. The following true bearings were determined: Wesleyan church cupola, 209° 59′.6; west edge of Moho Cay, 247° 02′.2.

Puntarenas, Costa Rica, 1907.—In the grounds surrounding the church of Puntarenas; 107.2 feet (32.68 meters) true north 28° 04′ east from southeast corner of buttress on north side of east or main entrance to church, 124.8 feet (38.04 meters) from northwest corner of buttress on east side of north entrance, 186.0 feet (55.69 meters) from northwest corner of buttress on north side at northwest corner of church, 94.9 feet (28.93 meters) from southeast corner of buttress on east side of northeast corner, and 45.1 feet (13.75 meters) from inner edge of inner curbstone of pavement to north; marked by copper tack in top of oak stake. The following true bearings were determined: flagstaff on soldiers' barracks at roof, 300° 32′.4; Puntarenas Church steeple, 22° 33′.9.

Roatan, Honduras, 1909.—In eastern part of town; 39 paces northeast of eastern corner of Christopher Fox's house, 38 paces southwest of western corner of Joseph Kelly's house, 16 paces northwest of path leading to Joseph Kelly's house; marked by stake driven flush with ground. The following true bearings were determined: flagstaff on office of Independent Steamship Company and Vaccaro & Brothers, 38° 32′.9; flagstaff on office of Commandant, 51° 06′.8.

Salamá, Guatemala, 1907.—On a knoll nearly surrounded by channel of the river Orotapa, somewhat southeast of the Hotel Oriental; about 350 feet (107 meters) from river on the west, about 100 feet (30 meters) to edge of an abrupt fall of ground to river bed on the east, and about 65 feet (20 meters) to brow of hill to the south. The following true bearings were determined: central tower of El Calvario, 73° 45′.5; tower of city building, 129° 29′.7; tower at entrance to church, 141° 05′.1; dome of church, 149° 53′.0.

San Carlos, Nicaragua, 1909.—At eastern edge of town on western end of plain west of custom house and pier, and at foot of a hill on top of which is what is apparently an earth fortification; 53 paces northwest of bank of San Juan River, 116 feet (35 meters) southeast of foot-bridge at fork of road leading to southwest part of town, and 19 feet (5.8 meters) west of path leading down from custom house road; marked by stake driven flush with ground. The edge of southwest corner of custom house near top is in true bearing 251° 23′.6.

San Felipe, Guatemala, 1907.—On ground of Ferro Carril Occidental de Guatemala, west of freight shed and southwest of passenger station and office building; 67.6 feet (20.61 meters) and 70.3 feet (21.43 meters) from the northwest and southwest corners respectively of foundation of freight house, 44.3 feet (13.50 meters) from fence line toward southwest, and about 95 feet

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CENTRAL AMERICA.—*continued.*

San Felipe, Guatemala, 1907—*continued.*
(29 meters) from fence line toward the north. The following true bearings were determined: south gable of ventilator in roof of Quarters, 225° 04′.4; flagpole at roof on station shed, 273° 39′.6.

San Jorgé, Nicaragua, 1909.—In south corner of a meadow inclosed by wire fence, southwest of Bodega, 101 feet (31 meters) east of palm in southwest part of meadow, 141 feet (43 meters) west of palm in southeast part of meadow, and 107 feet (33 meters) north-northwest from another palm; marked by 2-inch (5 cm.) round stake driven flush with ground. The southwest gable of the Bodega is in true bearing 215° 21′.6.

San José, Costa Rica, 1907.—In a pasture approximately 700 feet (213 meters) west of line of railway track leading to Alajeula, and about 450 feet (137 meters) south of church of San Francisco de Guadelupe, The pasture is on an elevation overlooking San José and may be generally located as north of Torres River and of a proposed national park on south side of river. The station is about 90 feet (27 meters) from a tree to the west-northwest, and about 340 feet, 100 feet, and 340 feet (104, 30, and 104 meters) from the wire fences east-northeast, south, and west-southwest, respectively; marked by copper tack in oak stake. The following true bearings were determined: clock tower of Guadelupe church, 265° 16′.9; north steeple of Aserro Church (on mountain), 14° 13′.2; south lightning rod on National Theater, 30° 07′.5; dome of Cathedral, 37° 37′.8; west steeple of Church de la Merced, 58° 42′.2; dome of church, San Francisco de Paula, 74° 33′.3.

San José, Guatemala, 1907, 1909.—The two stations are nearly identical, being located to the rear and southwest of the Hotel Unión, east of the track of the Central Railway of Guatemala, in a grove of six palm trees and two orange trees. The station of 1909 is 25.8 feet (7 meters) west of middle palm of south row, 12.8 feet (3.9 meters) north-northeast of most westerly palm of south row, 62.5 feet (19 meters) south of middle palm of north row, and 21 feet (6.4 meters) southwest of more westerly one of the orange trees, and about in line with the two orange trees; marked by round stake 2 inches (5 cm.) in diameter driven flush with ground. The following true bearings were determined: pipe at center of old well derrick, 313° 01′.0; north gable point on main roof of train shed, 337° 20′.0; flagstaff at east end of wharf company's building, 355° 48′.0; flagstaff at south end of roof of Commandancia building, 17° 36′.2.

San Marcos, Guatemala, 1907.—Just east of city, on the grounds of the public school, southwest of school building and west of band stand. Distances from the station are as follows: north 4° 11′.6 east to southwest corner of terrace wall around school building, 98.2 feet (29.93 meters); to southeast corner of the same, 162.9 feet (49.65 meters); to west face of balustrade wall, at band stand steps, 68.4 feet (20.84 meters). The steeple of El Calvario is in true bearing 62° 05′.1.

San Salvador, Salvador, 1909.—In pasture at north end of eleventh Avenue North, on middle one of three ridges and a little west of central line of street produced. To the south of station are four cement pillars for foundation of a house, the nearest corners of the two northern pillars being 34 feet (10.4 meters) southwest and 44 feet (13.4 meters) southeast from station. The point is marked by wood peg driven flush with ground. The following true bearings were determined: west spire of San Francisco church, 352° 52′.5; east spire of San Francisco church, 349° 59′.3; spire on large dome of Cathedral, 1° 49′.8; northeast edge of liberty monument on Campo Morti, 50° 36′.1;

Santa Rosita, Guatemala, 1907.—On a farm just at west edge of village and about 4 miles (6 kilometers) east of Guatemala City, the farm house being the first one on south side of road entering village. The station is a point from which the city is visible and is about three-eighths mile (0.5 kilometer) north of farm house in the cattle pasture. It is readily identified by reference to the watering place, constructed of brick and cement, the northeast and southeast corners of which at the ground are 60.3 feet and 71.5 feet (18.38 and 21.79 meters) respectively from station. It is 29.5 feet (8.98 meters) directly west of the wire fence, and 140 feet (42.7 meters) from corner of pasture to the south-southeast. The following true bearings were determined: southernmost church spire in Guatemala City, 106° 35′.1; dome of a church (rear of two steeples), 119° 39′.2; flagstaff at Fort Matremordas, 128° 29′.7.

San Ubaldo, Nicaragua, 1909.—On a hill north of the Bodega and pier, 79 paces almost north from southeast corner of stone wall, 73 paces northeast of corner of wall near gateway, 57 paces east of a large tree, 87.3 feet (26.6 meters) northeast of a large tree, 13 feet (4 meters) west of wall, and 22.7 feet (6.9 meters) southwest of tree standing near wall; marked by 2-inch (5 cm.) round stake driven flush with ground. East gable of the Bodega is in true bearing 28° 58′.6.

Sarchi, Costa Rica, 1907.—A little north of village, in pasture of the Ewa Plantation, belonging to Messrs. Inksetter Brothers, about 350 feet (107 meters) northeast of sawmill and other buildings; about 70 feet (21 meters) from a line fence to the northwest, and 75 feet and 90 feet (22.9 and 27.4 meters) from lines of two fences to the southwest. The following true bearings were determined: east steeple of Grecia Church, 304° 29′.9; west steeple of Santa Ana Church, 330° 08′.2; square tower at entrance of San Jeronimo Church, 123° 57′.9.

Tactic, Guatemala, 1907.—In a garden plot south of the hotel; 18.1 feet (5.52 meters) from the fence to the north, 28.5 feet (8.69 meters) and 36.0 feet (10.97 meters) from southwest and southeast corners respectively of southeast portion of hotel, about 24.5 feet (7.5 meters) from fence on the east and about 48 feet (15 meters) from fence on the west of garden. The following true bearings were determined: flagstaff on town building at roof, 262° 43′.8; small pyramid on north side of entrance to church, 286° 28′.9; north tower of El Calvario, 77° 27′.8.

Tegucigalpa, Honduras, 1909.—On east side of road to San Lorenzo; 135.5 feet (41.3 meters) northeast from tablet, on north end of Guaserique Bridge over the Tegucigalpa River, inscribed "Admon. Bonilla 1898," and 133.6 feet (40.7 meters) east of entrance inscribed "A borrotes Tabaco Puras Cigarros," and leading into grounds inclosed by brick walls on west side of road. The Guaserique Bridge is the second on road from Tegucigalpa to San Lorenzo. The point is marked by marble post 1 by 2 by 20 inches (2 by 5 by 51 cm.) set 1 inch (2 cm.) below surface of ground. The following true bearings were determined: south dome on front of San Miguel Arcangel Cathedral, 192° 50′.4; rear dome on the San Miguel Arcangel Cathedral, 194° 19′.2.

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Trapps Key, British Honduras, 1909.—On northwest corner of Key, 5 paces north of water's edge at ebb tide and 3 paces northwest of cocoanut palm overhanging sea; marked by stake driven flush with ground.

Truxillo, Honduras, 1909.—About 300 paces west of custom house, on the hard clay washed down onto beach from the hill on which the fort stands, about 5 paces from border line between the hard clay and beach, and 8 paces north of foot of hill; marked by tent peg driven flush with ground. The flagpole on Sr. José Julia's house opposite custom house bears 258° 28′.4.

Uvita Island, Costa Rica, 1907.—West of lighthouse and about 300 feet (91 meters) from station of 1898, it not being practicable to locate nearer; 32.5 feet (9.91 meters) from west corner of concrete footing of lighthouse, 43.0 feet (13.11 meters) from south corner, 36.0 feet (10.97 meters) from west corner of foundation of west post of framework, 52.1 feet (15.88 meters) from north corner of foundation of north post, 50.1 feet (15.27 meters) from west corner of foundation of east post, 43.4 feet (13.23 meters) from south corner of foundation of south post, and about 150 feet (46 meters) from quarantine hospital; marked by a copper tack in a tent stake. The following true bearings were determined: tower on quarantine building, 68° 53′.8; tower on westernmost cottage at Limon Hospital, 108° 24′.9; tower on Limon Hospital, 110° 07′.1; tower on easternmost cottage at Limon Hospital, 111° 54′.9.

Yaxja, Guatemala, 1909.—At village of Yaxja about 100 yards (91 meters) northeast of Laguna Yaxja; marked by stake driven in ground and covered with a flat stone and earth.

Zacapa, Guatemala, 1907.—About one-fourth mile (0.4 kilometer) east of railway station, on the road to the old town of Zacapa, near highest point of a conspicuous knoll; 13 feet (4.0 meters) north of a lone cactus, and about 40 feet (12 meters) from center of road to the southeast. The following true bearings were determined: south belfry tower of cathedral in Zacapa, 248° 49′.1; tower at entrance to cemetery, 255° 10′.9; cupola of railway depot tower, 81° 55′.3.

GREENLAND.

Cape York, 1908.—13 paces south from highest part of the most easterly projection of Cape York; east by south of highest hill of range parallel to water's edge, in a space covered over with tundra about large enough to accommodate a small tent; marked by center of mouth of a quart bottle, covered by rocks for protection, set in the tundra and resting on the gravel foundation.

Etah, 1908.—About 400 feet (122 meters) from extreme end of Reindeer Point and almost directly north of the coal depot. The point is almost inclosed by a ledge of rocks and the station is near northwest corner of the inclosure. The distance to bottom of a very precipitous rock in ledge almost north of station is 55.4 feet (16.89 meters), and to bottom of vertical stratum of rock in ledge west of station is 97.8 feet (29.81 meters). The station is marked by a pile of rocks. An auxiliary station, marked by a pinnacle of small rocks covered by larger rocks for protection, was established on a rocky point of land across the hill and about one-fourth mile (0.4 kilometer) north and west of primary station.

Godhavn, 1908.—On Disco Island. The U. S. Coast and Geodetic Survey station of 1896 was relocated, but on account of the proximity of a building it could not

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GREENLAND—*concluded.*

Godhavn, 1908—*continued.*
be occupied. A new station was established near the south side of a valley formed by two ledges of rock, southwest of the Inspector's house, south of a stone hut, and 34 paces east of the east corner of a second stone hut; marked by center of mouth of a small bottle sunk flush with ground and covered over with a pile of rocks. The following true bearings were determined: center of flagpole at base on bluff, 232° 13′.7; center of main flagpole at base, 232° 51′.1.

Hare Island, 1908.—About midway between eastern and western extremities of the northern shore of Hare Island and about 150 feet (46 meters) from the water's edge.

Holsteenborg, 1908.—In a well-defined valley running north and south on the eastern end of Krekertanguah Island and about one-fourth mile (0.4 kilometer) west from the village. West of the station is a very high steep hill. Three boulders are distant respectively 13, 6 and 12 paces to the northwest, east, and east-southeast. Station mark is top of rock sunk flush with the ground and covered over with other rocks. The following true bearings were determined: church spire, 293° 01′.3; center of base of flagstaff, 300° 41′.3.

Kangerdlooksoah, 1908.—On first plateau south of Eskimo village of Kangerdlooksoah and between village and a ridge of rocks running from east to west; marked by a bottle covered with stones.

North Star Bay, 1908.—On southeast shore of bay, between South Ravine and a hill and eastwardly of burial ground; marked by top of a round pint bottle sunk flush with ground and covered by stones. The following true bearings were determined: west tangent top of Mt. Dundas, 115° 50′.1; east tangent top of Mt. Dundas, 128° 54′.3.

Upernavik, 1908.—In an open space covered with tundra, on the northeast end of a small island about 600 feet (183 meters) west-southwest from point of land on which the village of Upernavik is located. Standing at station and facing the church spire used as an azimuth mark the central part of the perpendicular face of a large rock to the left is 19.2 feet (5.85 meters), the central part of the perpendicular face of a large rock to the right is 28.0 feet (8.53 meters), while behind and to the right the sharp corner where two ledges of rock meet is 44.5 feet (13.56 meters) distant. The station is marked by pinnacle of a small rock imbedded in the tundra, resting on the rock foundation and covered by a small pile of rocks. The following true bearings were determined: center of bottom of flagpole at side of Governor's house, 238° 30′.7; church spire in Upernavik, 250° 48′.0.

MEXICO.

Camargo, Tamaulipas, 1907.—About 4 miles (6 kilometers) southeast of town, about 400 feet (122 meters) northwest of depot, and 150 feet (45.7 meters) west of railway track; marked by wooden peg. The right edge of depot is in true bearing 345° 05′.2.

Chihuahua, Chihuahua, 1906.—Station A is in the open field south of the city and about one-eighth mile (0.2 kilometer) south of Guadalupe Cathedral; 180 feet (55 meters) south of a garden wall, measured through fork of the roads to the north-northeast; marked by a round hole in center of an oblong stone about 10 inches (25 cm.) long, projecting slightly above ground and surrounded by other stones. The following true bearings were determined: cross on Guadalupe

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MEXICO—*continued.*

Chihuahua, Chihuahua, 1906—*continued.*
Cathedral, 218° 42′.1; pipe on water tank, 6° 43′.1. Station B is on the east side of the city, in the open country back of the Porfirio Diaz Hospital, and 20 feet (6.1 meters) north of road; marked by a cross in top of a cement pillar 12 by 6 inches (30 by 15 cm.) projecting 2 feet (61 cm.) above ground. The pillar is the most southeasterly of three in a row, which mark some boundary line, the middle pillar being distant 60 feet (18.3 meters). The following true bearings were determined: cross on main tower, San Francisco Cathedral, 77° 56′.7; American church tower, 46° 29′.6; the Porfirio Diaz Hospital tower, 145° 33′.5.

Cuajimalpa, Mexico, 1907.—The stations are about 10 miles (16 kilometers) southwest of Mexico City, in the village of Cuajimalpa. Observations were made at two points, designated as A and B. Station A is about 15 feet (5 meters) true south 22° 15′.2 east of the magnetometer pier of the magnetic observatory, and 30 feet (9.1 meters) south of west from the observatory dip pier. Station B is the regular cement dip pier of the observatory, which is 30 feet (9.1 meters) southwest of the observatory magnetometer pier.

Cuatro Cienegas, Coahuila, 1907.—In the open ground about 100 yards (91 meters) north of Mexican International Railway depot and about 63 feet (19 meters) west of a large circular cement pillar. (This pillar is one of four set in a rectangle.) The station is marked by a wooden peg. The following true bearings were determined: Cathedral tower, 184° 30′.4; east gable of depot, 347° 11′.4.

Escalon, Chihuahua, 1906.—About 300 feet (91 meters) north of Northern Hotel and about 300 yards (274 meters) northeast of railway; marked by small wooden peg. The flagpole on post office is in true bearing 55° 35′.0.

Guaymas, Sonora, 1906.—On a small island in the harbor about 3 miles (5 kilometers) east of town and as nearly as could be determined is the same as that occupied by the United States Coast and Geodetic Survey in 1881. It is at high-water mark of spring tides, east of and close to the large round promontory known as Morro Ingles. To mark the point a large irregularly shaped stone was embedded in the sand about a foot (30 cm.); this projects about 6 inches (15 cm.) above general surface of ground. The point is 70.5 feet (21.5 meters) almost due north of a lone tree on the island, 92 feet (28.0 meters) to shore line northeast and 66 feet (20.1 meters) to shore line southwest. The following true bearings were determined: northeast corner of tall yellow building of the Consolidated Copper Company's smelter plant, 149° 21′.0; west gable point of long building at harbor entrance, 353° 32′.4.

Hermosillo, Sonora, 1906.—In public park known as Parque Ramon Cerral, just east of and adjoining the city; in extreme eastern part and a little north of center of the park in the midst of orange trees. To mark the point a wood post 2½ feet (76 cm.) long was driven into the ground; this projects about 6 inches (15 cm.) above the general surface of the ground. The point is 13 feet (4.0 meters), 17.3 feet (5.3 meters), 27 feet (8.2 meters), and 24 feet (7.3 meters) respectively from orange trees to the northwest, southwest, southeast, and northeast, and 46.2 feet (14.1 meters) from a large stone at corner of driveway to the northeast. The Catholic Church spire is in true bearing 41° 57′.3.

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MEXICO—*concluded.*

Jimenez, Chihuahua, 1906.—In a pasture about midway between the Mexican Central Railway depot and the main town, about 100 meters southeast of tramway; marked by wooden peg. The northeast and higher tower of cathedral is in true bearing 98° 17′.3.

Monterey, Nuevo Leon, 1907.—Two stations, A and B, were occupied. Station A is on a hill west of city and southeast of ruins of an old cathedral; marked by hole in top of a cement block 6 by 6 by 20 inches (15 by 15 by 51 cm.) projecting slightly above ground. The following true bearings were determined: Cathedral tower, 282° 48′.8; Trinity Church tower, 255° 16′.6. Station B is 63 feet 6 inches (19.35 meters) from station A, in the line to Cathedral tower; marked by a wooden peg. Intercomparisons of C. I. W. and Mexican instruments were made at this point.

Nueva Casas Grandes, Chihuahua, 1906.—Northeast of depot, in the open ground belonging to the Rio Grande, Sierra Madre and Pacific Railway Company, and about 200 yards (183 meters) east of the railway; marked by peg driven flush with ground.

Oaxaca, Oaxaca, 1907.—West of town, on west bank of Oaxaca River, 15 feet (4.6 meters) north of road leading to San Juan Cathedral and 12 feet (3.7 meters) south of an irrigation ditch; marked by wooden peg. The following true bearings were determined: Cathedral clock tower, 238° 39′.3; flagpole, statue of Juarez, 200° 04′.7; cement landmark on hill, 77° 03′.1.

Sabinas, Coahuila, 1907.—In an open square in the north corner of town, about 400 yards (366 meters) southwest of a spur of the Mexican International Railway, and about half a mile (0.8 kilometer) northwest of depot; marked by a hole in top of small flat stone sunk flush with the ground, and is 80 feet (24.4 meters) from fence on northwest side of square. A tower is in true bearing 115° 13′.8.

San Pedro, Coahuila, 1906.—About half a mile (0.8 kilometer) east of the city, in a cotton field of the "Rancho Memphis," and about 200 feet (61 meters) south of the ranch house; marked by wooden peg. The city clock tower is in true bearing 92° 52′.9.

Santa Barbara, Chihuahua, 1906.—On a hill northwest of town, 9 feet (2.7 meters) southeast of east corner of a graveyard and marked by wooden peg. The following true bearings were determined: Cathedral spire, 325° 43′.5; south gable of north smelter plant building, 203° 32′.3.

Sierra Mojada, Coahuila, 1906.—On southwest edge of town, about 300 yards (274 meters) south of depot, and marked by small wooden peg. The cross on Cathedral tower is in true bearing 238° 49′.4.

Temosachic, Chihuahua, 1906.—On open ground southwest of Chihuahua and Pacific Railway depot, 40 feet (12.2 meters) northwest of creek and 250 feet (76 meters) northeast of wire fence; marked by a wooden peg driven flush with ground.

NEWFOUNDLAND.

Battle Harbor, Labrador, 1905.—Station A is in southern part of Battle Harbor, about 20 feet (6 meters) south of an inclosure surrounding a pond about 16 feet (5 meters) in diameter. The lighthouse on Double Island is in true bearing 314° 40′.1. Station B_m is on Battle Island, northeast of Hospital of the Royal National Mission to Deep Sea Fishermen, and about midway between hospital and the base of a cliff which rises nearly perpendicular along the east. Lieut.

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NEWFOUNDLAND—*continued.*

Battle Harbor Labrador, 1905—*continued.*
Very's station of 1881 could not be occupied, as it was on the site of hospital, perhaps 75 feet (23 meters) distant from new station. The new station is 58.5 feet (17.8 meters) from northeast corner of main hospital building, 34.8 feet (10.6 meters) from center of a spring near the foot of cliff, and 105.2 feet (32.1 meters) from hospital flagstaff; marked by cross cut in the native rock, which is exposed at this point, though covered with soil from 1 to 3 feet (30 to 90 cm.) deep in the immediate neighborhood. The southeast corner of southeast chimney on house occupied by agent of Baine Johnson Fishing Co. is in true bearing 6° 01′.1. Station B was mainly an azimuth station, 11.83 feet (3.60 meters) nearly east from station B_m. Station C is near the center of Battle Island, approximately 500 feet (152 meters) east of the English Church, about the same distance north of wireless telegraph station, and about 800 feet (244 meters) northeast of B_m. It lies in a small hollow extending northwest and southeast. About 15 feet (5 meters) to the west is a step in the rock about 2 feet (61 cm.) high, extending northwest and southeast, while about the same distance to the north a small natural ditch extends northeast and southwest. The following true bearings were determined: Double Island light, 318° 42′.8; north gable wireless station, 337° 45′.2.

Bay of Islands, Newfoundland, 1905, 1909.—The station of 1905 and that of 1909 are identical within a few feet. The observations were made about one-fourth mile (0.4 kilometer) west of Bay of Islands railroad station, and about 300 yards (274 meters) from the wharf of Reid-Newfoundland Company; near the base of a small point of land projecting into the bay, 127.4 feet (38.83 meters) from railroad track, 85.4 feet (26.03 meters) from northern extremity of the point, and 24.9 feet (7.59 meters) and 24.7 feet (7.53 meters) from the shore to east and west respectively. The church spire at Birchy Cove, distant 5 miles (8 kilometers) bears 85° 01′.3.

Beachy Cove, Newfoundland, 1909.—In a field at end of first point beyond Portugal Cove, nearly in line with steeple of church on hillside at Portugal Cove and belfry on a small school behind the church at Birchy Cove; 38 feet (11.6 meters) from stone fence to the east, and 71 feet (21.6 meters) from stone fence to the north. The spire of Catholic Church on Bell Island bears 284° 34′.

Brigus, Newfoundland, 1908.—Observations were made over a rough stone west of the center of yard of Methodist school next the post office.

Cape Spear, Newfoundland, 1909.—At foot of hill below lighthouse, at mouth of small bay on north side of cape, 42 feet (12.8 meters) from edge of bank to seaward.

Carbonear, Newfoundland, 1909.—In a rocky field south of the head of the harbor, about half a mile (0.8 kilometer) from railway station; 48.5 feet (14.78 meters) from north fence, and 67 paces from gate southeast. The following true bearings were determined: top of tower of lighthouse on island in harbor, 259° 00′.1; spire of Anglican Church, 300° 52′.3; spire of Catholic Church, 160° 24′.6; spire of Anglican Church in town, 199° 19′.9; spire of the Methodist Church in town, 215° 46′.3.

Clarenville, Newfoundland, 1909.—About the middle of the small point of land jutting out into sea opposite and about 150 yards (137 meters) from railway station. The spike on top of railway water tank bears 80° 42′.6.

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NEWFOUNDLAND—*continued.*

Gambo, Newfoundland, 1909.—At foot of hill on north side of railroad; about 200 yards (183 meters) from railway station, 100 paces from road running parallel with railroad, about 14 feet (5 meters) from line of fence on near side of road leading to railroad, and about 42 feet (13 meters) from a mound of granite rocks. The wind vane on railway water tank bears 284° 23′.8.

Hawk Harbor, Labrador, 1908.—On a low rocky peninsula southeast of whale factory storehouse and office; 13 feet (4.0 meters) from southwest extremity of a ledge of rock, 29.0 feet (8.84 meters) from south edge of a rock in range with Sailor's Hotel, and 38.8 feet (11.83 meters) from a rock in range with flagpole on office building and storehouse; marked by the highest point of rough upper surface of a white granite rock weighing about 30 pounds, partially embedded in ground and covered with smaller rocks. The following true bearings were determined: northeast edge of Sailors' Hotel, 166° 39′.5; flagpole on office building, 147° 45′.8.

Millertown Junction, Newfoundland, 1909.—On low hill southeast of post office, near depot; 81 feet (24.7 meters) and 59.5 feet (18.14 meters) from paling fences northwest and northeast respectively. The top of railway water tank on south side of railroad bears 126° 50′.9.

Norris Arm, Newfoundland, 1909.—In field west of Jubilee Hotel and south of lake; 45 feet (13.7 meters) from south fence and 86 feet (26.2 meters) from west fence of the field. The bottom of flagstaff on courthouse bears 71° 24′.2.

Placentia, Newfoundland, 1909.—In a rocky field at top of a cliff on far side of small hill west of railroad station, at a point 70 feet (21.3 meters) from west edge of cliff. The spire of Roman Catholic Church in Placentia bears 352° 13′.2.

Placentia Junction, Newfoundland, 1909.—In triangle between main railway line and Placentia branch, 114 feet (34.7 meters) from main line and 38 paces from foot of a low hill. The center of near gable of railway station bears 245° 24′.9.

St. Georges, Newfoundland, 1909.—On Turf Point, about a mile northeast of city, in center of an old railway roadbed to the Point. The ground is deep peat and very unstable. The following true bearings were determined: Sandy Point Lighthouse, 150° 52′.5; cross on St. George Catholic Church, 27° 54′.4; spire of church in Sandy Point, 129° 17′.3.

St. John's, Newfoundland, 1905, 1909.—The station of 1881 was established in a large field in northwest corner of grounds surrounding Government House and marked by a sandstone post with "V 1881" cut on south face; station reoccupied in 1905. The stations of 1909 are in the same locality. Station C is 85 feet (25.9 meters) from center of stone marking the 1881 station, 86 feet (26.2 meters) from north fence, 129.9 feet (39.60 meters) from west fence, and 169.3 feet (51.60 meters) from northwest corner of the fence; marked by a sandstone block lettered C.I.W.1909 on top, a hole at the center defining the exact position. The following true bearings were determined: Congregational Church spire, 5° 10′.2; Cochrane Street Methodist Church spire, 315° 58′.1; nearest top corner of Lieut. Very's stone, 115° 11′.
Station A is located near station C and 16.5 feet (5.03 meters) southeastwardly from stone marking the station of 1881, 36 feet (11.0 meters) from north fence, and 92 feet (28.0 meters) from west fence of

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NEWFOUNDLAND—*concluded.*

St. John's Newfoundland, 1905, 1909—*continued.*
the inclosure. The following true bearings were determined: Cochrane Street Methodist Church spire, 3° 16′.8; Congregational Church spire, 314° 32′.8. Two auxiliary stations, B and D, were occupied in connection with the testing of the ship instruments, B about 50 feet (15 meters) north-northwest, and D about the same distance west-southwest of principal station.

Seldom-come-by Harbor, Newfoundland, 1908.—On Fogo Island, northern side of harbor, in a clear space between the church and Mr. Newell's house; about 20 feet (6 meters) from water's edge at high water, 4 feet (1.2 meters) south of perpendicular face of rock bluff about 10 feet (3 meters) high, 18 feet 5 inches (5.61 meters) from east end of bluff, 8 feet (2.4 meters) from first right-angle bend west of station, and 24 feet 5 inches (7.44 meters) from second and last bend; marked by small cross cut in top of rock projecting about six inches above ground. The tip of lighthouse on Cann Island bears 12° 14′.3.

The Narrows (St. John's), Newfoundland, 1909.—Two stations were occupied at the Narrows, one on North Head and one on South Head, approximately in line of the same azimuth marks, the flagstaff at the lighthouse at North Head and the southeast corner of the building intended for a smallpox hospital. The station at North Head is below the hospital, 30.5 feet (9.30 meters) from the rock face below the building, and 44 feet (13.4 meters) from the crown of the rock to seaward, the measurements being made along the inclined surface and in line joining the southeast corner of hospital and flagstaff at the lighthouse on South Head. The station at South Head is about half way up the hill between the sea and the flagstaff by the lighthouse, on a small path leading up the hill; about 2 feet (0.6 meter) east of the line joining the flagstaff and southeast corner of hospital building at North Head.

West Turnavik, Labrador, 1905, 1908.—The U. S. Coast and Geodetic Survey station of 1881 and 1896 was reoccupied in 1905 and 1908. It is a little east from the center of the smallest of the islands called Offer Turnavik, approximately half way between house occupied by Mr. Bartlett and that occupied by his men; a line from the flagpole southeast of Mr. Bartlett's house produced 17 paces past the northeast corner of the house terminates at the point; a remarkable glacial cut running nearly east and west is about 20 paces to the north. The point is marked by a deep drill hole in the native rock, which is here entirely bare of soil. The vertical bar in only window of an old house seen just south of house occupied by Mr. Bartlett's men bears 110° 54′.5. An auxiliary station was established in 1908, on account of the large amount of pig iron and scrap iron lying not far from the primary station, in a small valley across the harbor from the village and about half a mile (0.8 kilometer) north by west from the primary station. It is in a clear space on tundra among the rocks on the west side of the valley, near the northern limits of the valley, and is marked by a small bottle buried flush with ground and covered over with rocks. The flagpole east of Mr. Bartlett's house bears 328° 30′.3.

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Baldwin, Kansas, 1905, 1906, 1907.—Observations were made at the absolute magnetic observatory of the United States Coast and Geodetic Survey. The true bearing of flagpole on Science Hall is 131° 39′.4. At the end of 1906 a secondary station, designated as

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Baldwin, Kansas, 1905, 1906, 1907—*continued.*
tent, was occupied at a point about 50 feet (15 meters) from the absolute observatory, in line with flagpole on Science Hall of Baker University.

Berkeley, California, 1905.—The station of the U. S. Coast and Geodetic Survey of 1904, on the grounds of the University of California, was reoccupied. It is west of and in line with the north face of South Hall, 261.5 feet (79.7 meters) from its northwest corner, 31 feet (9.4 meters) west of center of path leading from gymnasium to North Hall, 46 feet (14.0 meters) north of the path leading from South Hall to Center Street entrance to the grounds, and 54 feet (16.5 meters) from edge of driveway; marked by a granite post 8 by 8 by 24 inches (20 by 20 by 60 cm.) set flush with ground and lettered U. S. C. & G. S. The following true bearings have been determined: west edge of gymnasium just above porch, 44° 34′.4; northwest edge of North Hall, 194° 46′.1.

Bowie, Maryland, 1908.—In an old field in northern part of town, 350 yards (320 meters) north of railroad station, 130 feet (39.6 meters) south of Episcopal Church, and 45 feet (13.7 meters) west of path leading to Episcopal Church; about in line with water tank tower and cross on Episcopal Church, and marked by an oak stake 3 by 4 by 24 inches (8 by 10 by 61 cm.) set almost flush with ground. The following true bearings were determined: cross of Episcopal Church, 174° 53′.2; water tank tower, 2° 47′.2.

Calais, Maine, 1906.—The U. S. Coast and Geodetic Survey station of 1895 was reoccupied as nearly as could be determined. It is in a pasture belonging to Mr. William Murchie, the point being about the middle of a large rock, roughly circular, 6 to 8 feet (2 meters) in diameter and rising about 1 foot out of ground. It is the more southerly of two similar rocks and near the middle of the pasture. The fences to the northwest and southwest are 202 feet and 279 feet (61.5 meters and 85 meters) distant respectively. The transit pier is 1,381 feet (421 meters) nearly due north, on top of the ledge back of the high school. The following true bearings were determined: transit pier, 179° 27′.6; flagpole on the high school building, 181° 38′.2.

Cheltenham, Maryland, 1908, 1910.—Observations were made on the pier designated as B_1 at the Cheltenham Magnetic Observatory of the United States Coast and Geodetic Survey. Besides the results given in the tabulation, other observations have been obtained by the Department at this Observatory, but these are not entered, as they have been used in the determinations of the constants of the instruments.

Chestertown, Maryland, 1908.—The station of 1897 was reoccupied. It is in the southeast part of grounds of Washington College, 130 feet (39.6 meters) north of the south edge of grounds, 97 feet (29.6 meters) northeast of an elm tree, and 123.2 feet (37.6 meters) from corner of a board fence inclosing field of Mr. White; marked by a blue marble post 5 by 5 by 24 inches (3 by 3 by 61 cm.) lettered on top "C.1. 1908" and sunk flush with ground; the period after the letter "1" marks exact point. The following true bearings were determined: cross on Catholic Church 27° 26′.8; cross on Methodist Protestant Church, 8° 15′.5; cross on the Methodist Episcopal Church, 1° 45′.6.

Derring Harbor, Shelter Island, New York, 1910.—The station is the north stone of a true meridian line established on the 10 acre wooded tract located on the bluff at the southeast end of Derring Harbor and

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Derring Harbor, Shelter Island, New York, 1910—*cont.* belonging to Prof. Charles Lane Poor, of Columbia University. The two meridian stones are granite posts, dressed 6 by 6 inches (15 by 15 cm.) on top and about 4 feet (1 meter) long, the dressed portion extending about 8 inches (20 cm.) from the top. Each is lettered on top "C.I.W. 1910" and has a half-inch hole, drilled about 2 inches (5 cm.) deep at the center; these drill holes mark the precise points. The meridian line is approximately in the middle part of the level portion of the tract, the north stone being about 15 meters from edge of bluff, the south stone 57.6 meters from north stone. The following distances were measured from the north stone to copper nails driven in the nearby trees, which form a triangle about the station: north oak tree, 4.65 meters; east dead twin trees, 5.64 meters; west dead tree, 4.22 meters. The following true bearings were determined: tip of tower of Union Chapel, Shelter Id. Heights, 94° 41′.3; middle of top of tall chimney, Greenport Water Works, 120° 23′.6; flagstaff at Greenport Schoolhouse, 144° 18′.0; middle top of tall chimney of Greenport Hygeia Ice Co., 151° 18′.7; tip of spire of First Baptist Church, Greenport, 154° 15′.1.

Eastport, Maine, 1906.—Two stations, A and B, were occupied. The old station at Fort Sullivan, established by the U. S. Coast and Geodetic Survey, could not be relocated with certainty, owing to removal of buildings used as references. Observations were therefore made at a point designated A as near the original station as could be approximated, this point being 90 feet (27.4 meters) south of the southeast corner of powder magazine and 50 feet (15.2 meters) west of the southwest corner of Mrs. Kernan's house.

Station B is about one-sixth mile (.3 kilometer) northeast of the Eastport stand pipe, which stands on a hill north of town; on a rocky knoll in a pasture belonging to Mr. J. R. Roche and about 181 feet (55 meters) from the foot of the more easterly of two rocky points known as the "Batteries," about 450 feet (137 meters) from fence along road leading from town, and about 260 feet (79 meters) from fence marking the south side of Mr. Roche's field. The following true bearings were determined: left edge of stand pipe, 282° 11′.6; spire on Congregational Church, 316° 23′.9; spire on Unitarian Church, 333° 00′.8; lighthouse on east point, 348° 43′.8.

Gardiner's Island, New York, 1909.—At the western extremity of the island, about 100 feet (30 meters) back from the shore, on level ground about 5 feet (1.5 meters) above the water; marked by granite post 6 by 6 by 30 inches (15 by 15 by 76 cm.) projecting about 6 inches (15 cm.) above general surface, and lettered on top C.I.W.1909, with small drill hole defining exact point.

Goat Island, California, 1905, 1908.—The station is the U. S. Coast and Geodetic Survey station of 1904. It is on a military reservation of the United States Government near the center of the plateau just west of the hill at the extreme eastern end of the island, is nearly in line with the top of the hill and the smokestack at the naval training station, and about 50 feet (15 meters) north of the line of the wireless mast on highest part of island, and the flagpole on the southern part of the lawn in front of the officers' quarters; marked by small hole in top of a rough stone 6 by 6 by 12 inches (15 by 15 by 30 cm.) with a flat top which projects slightly above the general surface. In 1908 three secondary stations were established. The first is 74 feet (22.6 meters) true north 56° 08′ east of main

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Goat Island, California, 1905, 1908—*continued.* station. The second and third, used for ship instruments, were about 45 feet (14 meters) west of and 35 feet (11 meters) northwest of main station, respectively.

Greenport, New York, 1909, 1910.—Two stations, A and B, were occupied at this point. Station A is identical with the U. S. Coast and Geodetic Survey station of 1904. It is in the northern part of the school grounds just south of the row of large maple trees, marked by a marble post lettered on top "U. S. C. & G. S. 1904," with a hole at center marking the precise point. The Presbyterian Church spire is in true bearing 203° 22′.2.

Station B is 52.7 feet (16.06 meters) from station A in the line from A to spire of Catholic Church. The Catholic Church spire is in true bearing 45° 27′.4.

Havre de Grace, Island, Maryland, 1908.—In an inclosed field on the large island in the Susquehanna River, north of Havre de Grace; about 350 yards (320 meters) south of Baltimore and Ohio Railroad bridge, and almost due north of water tank in Havre de Grace; 26 paces east of wire fence running along the wood, 62 paces north-northeast of a large stone at south corner of the wood, and 81 paces south-southwest of a large spreading poplar; marked by an oak stake driven flush with ground. The following true bearings were determined: middle point on draw span of Pennsylvania Railroad bridge, 352° 37′.0; church spire, 13° 57′.6; water tank in Havre de Grace, 0° 35′.5.

Havre de Grace, Lighthouse, Maryland, 1908.—In the grounds of the Havre de Grace lighthouse, close to U. S. Coast and Geodetic Survey station of 1899, the marking stone having been removed; about in line between the lighthouse steps and doorsteps of lightkeeper's house, 55 paces west-northwest of lighthouse door, 24 paces southeast of doorsteps of lightkeeper's house, and 10 paces south-southeast of dovecote; marked by tent peg driven flush with ground. The middle point on draw span of Pennsylvania Railroad bridge bears 176° 48′.6.

Juneau Hill, Alaska, 1907.—The U. S. Coast and Geodetic Survey station of 1900 and 1903 on the hill east of town was reoccupied. It is marked by a nail in a spruce stump about 6 feet (2 meters) in diameter.

Juneau Island, Alaska, 1907.—The U. S. Coast and Geodetic Survey station of 1900 and 1903 near northeast end of island was reoccupied; it is 2½ feet south of a large and very prominent dead spruce tree and marked by the central one of three large copper nails driven in a row in the central one of three large roots diverging from trunk of tree toward the south.

Juneau School, Alaska, 1907.—The U. S. Coast and Geodetic Survey station of 1903 was reoccupied; in southwest corner of native school yard 6.6 feet (2.01 meters) nearly southwest from southwest corner of school building and 4.2 feet (1.27 meters) northwest from an electric light pole.

Key West, Florida, 1905.—The U. S. Coast and Geodetic Survey station of 1896 and 1903, on the shore, in grounds of Key West barracks, at the extreme northeast of town, was reoccupied. It is in line with the east side of hospital, and 79.2 feet (24.14 meters) and 98.5 feet (30.02 meters) from outer edges of piers under the northeast and northwest corners of the hospital porch respectively, and 66.4 feet (20.24 meters) south of north fence about the barracks; marked by a hole chiseled into the rock which at

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UNITED STATES—*continued.*

Key West, Florida, 1905—*continued.*
this point lies about 6 inches (15 cm.) below general surface of ground, and is witnessed by a wooden stake driven into this hole and extending to surface of ground. The following true bearings were determined: northwest tower of armory, 358° 32′.7; southeast tower of armory, 356° 33′.6.

Knight's Key, Florida, 1908.—On west shore of Knight's Key, about one-half mile (0.8 kilometer) east of Knight's Key dock, one-fourth mile (0.4 kilometer) south of railroad, and 24 paces east of the sea; marked by the intersection of two lines cut in top of a pine stake 3 by 5 by 30 inches (8 by 13 by 76 cm.) projecting 2 inches (5 cm.) out of ground. The top of Sombrero lighthouse is in true bearing 351° 24′.5.

Kutkan Island, Alaska, 1907.—On the eastern point of land on Kutkan Island, 30 feet (9 meters) from the water's edge, at high tide, on the north side, 12 feet (4 meters) on the south side, and 50 feet (15 meters) from extreme eastern edge of island. A cross, cut in the top of a large irregular rock projecting about a foot above ground, marks the exact spot. The following true bearings were determined: pier at Sitka absolute magnetic observatory, 156° 49′.3; U. S. Marine Corps barracks flagstaff, 148° 51′.2; Mission flagstaff, 187° 33′.1.

Long Beach, New York, 1909.—In line with second oyster ground range, consisting of two tall white poles standing back from the beach, 27 feet (8.3 meters) south of nearer pole and about 100 feet (30 meters) from water's edge; marked by a granite post 6 by 6 by 30 inches (15 by 15 by 76 cm.), projecting about 6 inches (15 cm.) above ground, and lettered on top, C.I.W.1909, a hole in the center defining the precise point. The following true bearings were determined: Long Beach lighthouse, 57° 00′.8; Orient Church spire, 166° 59′.7.

Miami, Florida, 1905, 1908.—The Coast and Geodetic Survey station of 1903, near the site of old Fort Dallas, in the grounds of the Seminole Club in the southern part of town, was reoccupied. It is 62 paces south of the clubhouse, 72 feet (21.9 meters) southeast of flagpole, and 45 paces north of the Miami River; marked by a half-inch (1 cm.) drill hole in top of a limestone post 7 by 7 inches (18 by 18 cm.) set flush with ground; the top of stone is lettered "U. S. C. & G. S. 1903." The southeast edge of Royal Palm Hotel is in true bearing 248° 37′.4.

Middlebury, Vermont, 1910.—The U. S. Coast and Geodetic Survey station of 1905 was reoccupied. It is west of Middlebury College and near the summit of the hill owned by the College; about 600 feet (183 meters) west of the south side of Starr Hall, 192 feet (58.5 meters) northeast of a lone maple tree, and about 40 feet (12 meters) east of the summit of the hill; marked by a marble post, 7 inches (18 cm.) square, sunk flush with ground and lettered, U. S. C. & G. S., 1905, a drill hole in center indicating the precise point. The gable of east end of C. James' house was found in true bearing 111° 07′.4.

Newburyport (Plum Island), Massachusetts, 1905.—About 4 miles (6 kilometers) east of the city, on Plum Island, north of Plum Island Hotel, as near the U. S. Coast and Geodetic Survey station of 1898 as could be determined, and identical with their station of 1905; 113 feet (34.4 meters) west of the west line (produced) of the hotel barn, measured at right angles to the line at a point 445 feet (136 meters) north of the northwest corner, and 12 feet (3.7 meters) east of a road; marked

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Newburyport, (Plum Island), Massachusetts, 1905—*cont.*
by a marble post. The following true bearings were determined: Congregational church spire, 88° 04′.1; Old South church spire, 101° 32′.3.

New York (Bronx Park), New York, 1909, 1910.—Station A is in Botanical Gardens of Bronx Park, east of Botanical Museum and east of the Bronx River, at the highest point, and near center of open space southeast of stone hut. The southwest corner of stone hut is distant 193.6 feet (59.02 meters), a lamp-post on the west side of park road is 74.6 feet (22.73 meters) to the east-northeast, and a second lamp-post is 93.2 feet (28.41 meters) to the southeast on the east side of park road. The station of the U. S. Coast and Geodetic Survey is distant 129.5 feet (39.45 meters) to the west. The station is marked by a heavy wedge about 16 inches (40 cm.) long, projecting about 4 inches (10 cm.) above the general surface. The following true bearings were determined: flagpole on police station, 128° 37′.0; southwest corner of stone hut, 166° 33′.8. In 1910 an auxiliary station, B, was also established on the line joining the main station with flagpole on police station of Precinct No. 79, produced northwestwardly 67.3 feet (20.5 meters). This point is about 2½ feet (0.8 meter) lower than the principal station and on the edge of a small bluff.

Norfolk, Virginia, 1905.—The U. S. Coast and Geodetic Survey station established in 1897 was occupied. This station is in the northeastern suburbs of the city in New City Park, in an open space just south of road leading to the new pavilion; marked by heavy granite post projecting 4 inches (10 cm.) above ground, and with its top dressed 4 by 4 inches (10 by 10 cm.) and lettered, U. S. C. S. A small hole and bolt mark the precise point. This stone and a similar one to the north near the woods mark a meridian. Electric car disturbances are very bad at this point.

Pembina, North Dakota, 1906.—In the approximate location of U. S. Coast and Geodetic Survey station established by R. L. Faris in 1896 and reoccupied in 1905 by H. W. Fisk; about 700 feet (213 meters) southward from junction of the Pembina and Red rivers, on land owned by the village and now used as a baseball park; 536 feet (163.4 meters) east of the west side of county road and 73 feet (22.2 meters) from board fence along the east side of the park, this distance being measured along the line perpendicular to the county road. From a point 6 feet (1.8 meter) west of station, a flagpole near the park and the Catholic Church spire appear in line. The station is marked by a cement block 6 by 10 by 24 inches (15 by 25 by 60.9 cm.) sunk flush with ground and marked U.S.1905. The following true bearings are reported by the Coast and Geodetic Survey: Icelandic Lutheran Church spire, 41° 53′.8; Catholic Church spire, 170° 04′.0.

Plum Island (Fort Terry), New York, 1910.—On sand beach about one-fourth mile (0.4 kilometer) northwest of extreme southerly point of the Island, which is a military reservation also known as Fort Terry; this point is known as Pine Point. The station is about 80 paces from the shore and about equidistant from the last batteries on the southeast and southwest sides of the Island. The following true bearings were determined: Orient Point Light, middle point of lantern, 80° 28.′3; Plum Point Light, middle point of lantern, 134° 09′.7; west edge of southerly wall of extreme southeast battery known as Robert Floyd Battery, 239° 02′.3.

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UNITED STATES—*continued.*

Presidio (San Francisco), California, 1905.—The station of the U. S. Coast and Geodetic Survey of 1904, at the triangulation station on Presidio Hill, northwest of gate on south side of Presidio grounds at the edge of the woods, was reoccupied; marked by stone post 6 inches (15 cm.) square on top, projecting 6 inches (15 cm.) above ground and lettered on top U. S. C. & G. Survey, 1881. The following true bearings have been determined: cross on Lone Mountain, 325° 53′.8; center of top of Drake Cross, 27° 03′.7.

Ram Head, Ram Island, New York, 1910.—On the extreme southeasterly tongue of Ram Island, on low-lying sand beach, about 100 yards (91 meters) from end of point projecting into the entrance to Coecles Harbor, and in middle of the tongue in an east-and-west direction. The following true bearings were determined: Cedar Island Light, middle of lantern, 334° 24′.4; cross on spire of St. Mary's Episcopal Church, 92 37′.7.

Sammy's Beach, New York, 1909.—On a sandy ridge about midway of the length of the beach, and about 100 feet (30 meters) from the shore line; marked by granite post 6 by 6 by 30-inches (15 by 15 by 76 cm.) lettered on top C. I. W. 1909, with a small drill hole at center marking the precise point.

San Diego, California, 1905, 1906.—Five stations were established here; these are designated as San Diego 1, Secondary, 11, 111, and C. & G. S., 1897.

The first, San Diego I, is near the northern point of North Coronado Beach Island; near the shore of the bay, facing the city, about 320 paces west of the west corner of engine house of Marine Railway (Spreckels) and 58 paces from road that runs along the beach. Beacon No. 10 bears approximately north-northwest from the station, which is marked by a spruce post, 6 by 6 by 50 inches (15 by 15 by 127 cm.) set with its faces approximately with the cardinal points and projecting about 1 foot (30 cm.) above the surface; the letters C. 1. are cut on the north face and 1905 on the south face. The following true bearings were determined: School of Theosophy, 96° 47′.8; stand pipe, 187° 54′.2; flagpole on south tower of Coronado Hotel, 338° 38′.4. A secondary station, designated as *secondary station*, was established 50 feet (15.2 meters) south-southeastward in the line toward the Coronado Hotel from San Diego I.

San Diego II is on the northwest portion of North Coronado Beach Island, about midway between the C. & G. S. station at Quarantine and Station I; about 75 yards (69 meters) from the northwest beach of North Coronado Beach Island, and in the line joining Harbor Beacon No. 2 and the south end of the most southerly building on Quarantine Wharf; marked by a redwood post 4 by 6 by 44 inches (10 by 15 by 112 cm.) projecting about 8 inches (20 cm.) above ground. The letters C.I. and the numeral II are cut on the two faces which face the north and south respectively. The following true bearings were determined: south tower of Coronado Hotel, 306° 40′.8; old lighthouse, Point Loma, 33° 37′.7; central dome, School of Theosophy, 117° 28′.1.

San Diego III is on the north shore of San Diego Bay, on a low beach northwest of Dutch Flat, and about 100 yards (91 meters) north 25° east of a triangulation signal on the sand spit; marked by redwood post 4 by 6 by 52 inches (10 by 15 by 132 cm.) extending about 10 inches (25 cm.) above ground and having the letters C. I. cut in the north face, and a hole near the center of the top. The following true bearings were determined: south tower

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UNITED STATES—*continued.*

San Diego, California, 1905, 1906—*continued.*
of Coronado Hotel, 337° 19′.7; old lighthouse, Point Loma, 24° 08′.1; School of Theosophy, 63° 28′.1.

The C. & G. S. 1897 station, occupied in 1905, is that established by the Coast and Geodetic Survey in 1897. It is in the southeast portion of the city, about 150 feet (46 meters) southwest of where Seventh and Fir streets would intersect if extended into the park; marked by redwood post 4 by 4 by 36 inches (10 by 10 by 91 cm.) projecting about 1 foot (0.3 meter) out of ground, lettered U. S. MAG. and 1897 on its north and west vertical faces respectively.

San Rafael, California, 1905, 1908.—There are three stations, two being those of the U. S. Coast and Geodetic Survey of 1897. They are 1.1 miles (1.8 kilometers) northwestward from the county courthouse, on the eastern slope and near the top of a hill, about 375 feet (115 meters) distant from one of the water company's reservoirs. There is a meridian line marked by two marble posts 8 by 8 by 48 inches (20 by 20 by 122 cm.) projecting about 24 inches (61 cm.) above the surface of the ground; the north stone is lettered U. S. C. & G. S. on its west vertical face, MAG. STA. on the south face, and 1897 on the east face, and bears a cross on its upper face marking the exact point. The south stone is set about 2300 feet (701 meters) true south of the station, its north vertical face being lettered MER. MARK., the east face U. S. C. & G. S., and the west face 1897.

In 1897, 1905, and 1908, dip circle observations were made at a point, designated as dip station, 50 feet (15 meters) from the north stone, and magnetometer observations were made at a point, designated as magnetometer station, 10 feet (3.0 meters) from the north stone in the extension of the line from flagstaff on the county courthouse to the north stone. In 1908 observations were also made over the north pier. The flagpole on county courthouse is in true bearing 289° 46′.0.

Sault Ste. Marie, Michigan, 1906.—Same as the U. S. Coast and Geodetic Survey station established in 1902, in a large field west and south of the administration building at new site of Fort Brady; 94 paces south of a small brick powder magazine and 69 paces from wire fence along the road south of station; marked by a limestone post 6½ by 8 by 42 inches (16 by 20 by 107 cm.) set flush with ground and lettered U. S. C. & G. S. 1902. The iron flagstaff on east side of parade grounds is in true bearing 254° 23′.8.

Shelter Island Heights, A, New York, 1910.—In the field between Miss E. G. Duvall's cottage and the Oxford House.

Sitka, Alaska, 1907.—Two stations occupied; the principal pier in the Sitka auxiliary magnetic observatory of U. S. Coast and Geodetic Survey, and in the regular absolute house.

Swampscott, Massachusetts, 1906.—Station A is in the grounds at the rear of Phillips School situated on a high bluff above the town; marked by the middle of a natural depression near the center of a large rock, about 12 feet (4 meters) in diameter, northeast of the school building and 66 paces from northeast corner of main building, and 51 paces from northeast corner of small addition on the east end of the building. The following true bearings were determined: east corner of school building 31° 11′.8; west corner of school building, 67° 36′.2. Station B is on the southeast corner of a large rock jutting out into the harbor back of the third house east of 217 Humphrey Avenue. Tower on Lincoln Hotel is in true bearing 300° 34′.3.

NORTH AMERICA.

UNITED STATES—*concluded.*

Washington, District of Columbia, 1904 to 1910.—Observations for determination of constants and intercomparisons of standards during seven years have been made at four pier stations, Am, Cm, Ai, and Ci, and an auxiliary station B. The pier stations are in two non-magnetic houses. These houses and stations are west-northwest of offices of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington in the Ontario Apartment House, and immediately southeast of the National Zoological Park, on the bluff overlooking the bear pit in the southeast part of the park. In 1905 the hut station of the United States Coast and Geodetic Survey in the grounds of that Bureau was also occupied.

Waycross, Georgia, 1905.—The U. S. Coast and Geodetic Survey station of 1905, in the north end of town, in the north corner of a small cemetery, was reoccupied. It is 87 feet (26.5 meters) from the fence bounding the lot on the northwest, and 93.5 feet (28.5 meters) from fence on the northeast; marked by a marble post 24 inches (61 cm.) long set with top 6 inches (15 cm.) below ground, and having a triangular cross section, with sides about 7, 7, and 10 inches (18, 18, and 25 cm.); a hole drilled in center of top of stone marks the point.

SOUTH AMERICA.

BRAZIL.

Amazon 1, Amazonas, 1910.—On north bank of river and 30 feet (9.1 meters) from two large trees standing in the water a few feet from shore.

Amazon 3, Amazonas, 1910.—On northeast bank of river, about 10 yards (9 meters) from water's edge, but on ground covered during highest water.

Amazon 4, Amazonas, 1910.—On left bank of river, on ground covered with water during part of year.

Amazon 5, Amazonas, 1910.—On high bank on right side of river. The home of a rubber-gatherer is about 100 yards (91 meters) back from the shore.

Amazon 6, Amazonas, 1910.—On a rocky shelf on south bank of river, about 15 yards (14 meters) from edge of bank.

Amazon 7, Amazonas, 1910.—On high south bank of river and just west of a small tributary extending toward southwest; about 5 paces from edge of river bank.

Amazon 8, Amazonas, 1910.—On a sand bar near north bank of river about 2 miles (3 kilometers) above mouth of Japura River.

Amazon 9, Amazonas, 1910.—On a sand bar near south bank of river just east of a small tributary which extends towards the south.

Amazon 10, Amazonas, 1910.—On north bank of river on a mud flat just opposite two islands; covered with water when the river is high.

Amazon 11, Amazonas, 1910.—On northwest bank of river on a large sand bar.

Amazon 12, Amazonas, 1910.—On a sand bar on south bank of river, just across from a few small native huts.

Amazon 13, Amazonas, 1910.—On a sand bar on east bank of river about 2 miles (3 kilometers) above mouth of Ica River and just north of a small tributary which extends towards the east. Marked by a stake projecting a foot (0.3 meter) out of ground.

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BRAZIL—*continued.*

Amazon 14, Amazonas, 1910.—On south bank of river north of city of Sao Paulo de Olivenca. The point is located on a mud shelf which is covered with water when the river is high, and is almost in line with east end of an island and church in city.

Amazon 15, Amazonas, 1910.—On west bank of river, near north end of large sand bar; the high-water shore-line is about 400 yards (366 meters) farther inland.

Amazon 16, Amazonas, 1910.—On a sand bar on southeast bank of river; the high-water shore-line is about 300 yards (274 meters) farther inland.

Manáos, Amazonas, 1910.—Station I is as near as possible to that occupied by the Brazilian Commission in 1903. It is located on west side of Morro des Educandos and near shore of a small bay projecting from the Negro River; about 200 yards (183 meters) from bank of river, 50 feet (15.2 meters) from shore of bay at high water, about 52 feet (16 meters) east-southeast of a large tree standing close to shore of bay, and about 39 feet (12 meters) south of path leading up the hill from boat landing which is near large tree. It is marked by a wooden stake projecting about 2 inches (5 cm.) above surface of ground. The following true bearings were determined: spire seen through large tree near station, 120° 05′.3; flagpole on cupola seen to the left of the wireless telegraph station poles, 180°. 26′.2.

Station II is in the vacant square south of the Instituto Benjiman, and west of the house used by the employees of the Casa Alden. It is located 29 paces from fence about garden of Casa Alden, and 65 paces from the wall about the garden of the Instituto Benjiman. It is marked by red sandstone with about 3 by 4 inches (8 by 10 cm.) of surface showing above surface of ground.

Pinheiro, Para, 1910.—Three stations, A, B, and C, were occupied at this point. The stations are situated in the town of Pinheiro on the east bank of the Para River and about 10 miles (16 kilometers) north of the city of Para. Station A is the same as the Brazilian station of 1903. It is on the point of land directly in front of the San Sebastido church and 69.5 meters from its southwest corner; it is about 100 meters in the direction northeast from end of government wharf and about 10 meters from edge of steep river embankment. This station is marked by concrete blocks 28 cm. square by 4½ cm. thick built up to a height of 76 cm. On the top block there is a copper plate bearing the date of the Brazilian observations, name of the observer, latitude, longitude, and magnetic elements, at the time of observation. The exact point is at the edge of copper plate directly over second "R" in the word "Directoria"; this point is 8.9 cm. from north edge of block and 11.8 cm. from east edge. The following true bearings were determined for station A: large brick chimney in Para, 1° 36′.2; outer gable end of shelter house on pier at Pinheiro, 42° 20′.9; tip of spire of San Sebastido Church, 262° 50′.2. Station B is 15.6 meters from station A in the line from Station A to the large brick chimney in Para. Station C is 15.85 meters from station B in line from station B to large brick chimney in Para.

Rio de Janeiro, Federal District, 1910.—Three stations, A, B, and C, were occupied at Freitas Beach. They are on the beach about 250 meters west of present terminus of the Ipanema car line from Rio de Janeiro on grass-covered sand above the high-water mark. Station B, the main station, is about 12 meters from edge of grass and about 20 meters from ridge of a small sand hill to the landward. It is marked by a wood

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BRAZIL—*concluded.*

Rio de Janeiro, Federal District, 1910—*continued.*
post 3 by 4 by 36 inches (8 by 10 by 91 cm.). The following azimuths were determined from station B: center of top of pavilion on the summit of Corcovado, 166° 46′.2; landward wireless telegraph pole at the bottom, 279° 52′.8; lighthouse on Raza Island, 326° 09′.8. Station A is 23.6 meters 99° 52′.8 west of true south from station B, being in line of station B and landward wireless telegraph pole. Station C is 18.3 meters from station B in line from station B to landward wireless telegraph pole.

COLOMBIA.

Banco, Magdalena, 1909.—Just to northwest of town, in field belonging to Sr. Bacilio Mossa (the second street down the river from the church, and running off at right angles to the river, ends abruptly here) on a rise in northeast corner of field, 70.5 feet (21.5 meters) from road and 17 feet (5.2 meters) from a tree to northwest. Marked by a wooden peg.

Barbacoas, Cauca, 1909.—South of town on a spur rising behind sawmill of Señor Augusto Ortiz and about 50 yards (46 meters) from mill, up the spur.

Bodega Central, Magdalena, 1909.—A short distance up Magdalena River from Bodega Central, in first clear space on bank of stream emptying into river. Marked by wooden peg.

Bogota, Cundina-Marca, 1909.—In field belonging to Señor Manuel José Umaña, on right-hand side of continuation of Calle 26 from Bogota to Salitre, about half a mile (0.8 kilometer) past the cemeteries. In southwest corner of second field from road, 100.5 feet (30.6 meters) from a mud wall on the west, and 90 feet (27.4 meters) from a ditch on the south. The point is marked by wooden peg. The following true bearings were determined: tower of Iglesia de la Peña, 163° 23′.1; middle of near face of chimney of El Guitron brick and tile factory, 311° 12′.3.

Buenaventura, Cauca, 1909.—About 150 yards (135 meters) distant from cable station, in a small basin just below top of narrow ridge which runs through part of town parallel to river but turns to left at cable station.

Calamar, Bolivar, 1909.—In field belonging to Señor Esteban Miel, on side of railroad farthest from river, and may be reached by following the street past the Hotel Colombia, then taking first turn to left which leads direct to gate of field which is just past the railroad. 49 paces from south fence of field, 15 paces from a tree southeast, 38 paces from a tree east, and 120 paces from gate of fence around house near railroad. Marked by a wooden peg.

Cartagena, Bolivar, 1908, 1909.—The observations in 1908 and 1909 were made in the same general locality on the beach outside walls of town. The station of 1909 is in the angle between the walls and the small projecting fort La Tenaza, 90 feet (27.4 meters) from the town wall and 70 feet (21.3 meters) from the wall of the fort. Marked by a wooden peg. The central column of iron lighthouse in course of construction was found to be in true bearing 51° 54′.3.

Casa Fria, Cauca, 1908.—One of a string of isolated houses along the road from Pasto to Papayan and about a mile (1.6 kilometers) in a straight line from Mercaderes, a very small township; just off the road leading from Mercaderes to the north and about 20 yards (18 meters) from house.

Girardot, Cundina-Marca, 1909.—On top of low hill southeast of cemetery and southeast of town, on

SOUTH AMERICA.

COLOMBIA—*continued.*

Girardot, Cundina-Marca, 1909—*continued.*
property of Señor Roja, in second large field from road; 30 paces from a gate southwest and 18 paces southeast from corner of wire fence.

Honda, Tolima, 1909.—Just north of town, on a terrace about 50 feet (15 meters) high overlooking railroad station, 3 paces from south edge of terrace and marked by wooden peg. The top of the church tower is in true azimuth 1° 04′.7.

La Plata, Tolima, 1908.—On a small rise just north of town on west side of continuation of street which passes in front of Cathedral, and south of cemetery; 35½ feet (10.8 meters) east of a stone fence, 60 feet (18.3 meters) southeast of corner of a bamboo fence, and 43 feet (13.1 meters) nearly north of a tree which is 2 feet (0.6 meter) east of line to tower of Cathedral. The true bearing of the tower of the Cathedral was found to be 16° 52′.4.

Lorica, Bolivar, 1909.—North of the town, on a slight rise in a field belonging to the brothers Martinez, of the firm of Diego Martinez & Co., and a short distance west of road crossing swamp between town and field. Marked by a wooden peg. The middle of cross on facade of church is in true bearing 326° 39′.4.

Mompos, Bolivar, 1909.—In field belonging to Señor Miguel Cabezas, on north or down-river side of cemetery, 42 paces from an isolated tree to south and 7 paces from a large tree to north. Marked by wooden peg. Street leading to cemetery is called Calle de Colegio.

Natagaima, Tolima, 1909.—On bank of Magdalena River, about 90 paces down stream from where the road from the town strikes the river, and 7 paces west of the west bank of river. Marked by wooden peg. The tower of church in Natagaima is in true azimuth 128° 40′.2.

Neiva, Tolima, 1908–1909.—On the rise to east of town in open country just beyond the houses and a little to south of Ninth Street, northwest of a clump of scrub and cactus.

Pasto, Cauca, 1908.—On top of a round hill just outside the town to southeast, above the thermal baths. The following true bearings were determined: cross on tower of Iglesia de Santiago, 123° 24′.5; cross on tower of Cathedral, 180° 32′.5; top of tower of Iglesia de Las Mercedes, 200° 43′.9.

Popayan, Cauca, 1908.—On top of a small rise on the outskirts of the city to the southeast, just off Calle 4, at the east end, behind the Iglesia de L'Hermita, 48 feet (14.6 meters) west of a ditch and 92 feet (28.0 meters) southeast of the corner of a hedge and fence. Marked by wooden peg. The following true bearings were determined: gable end of Iglesia de Puelenge, 78° 57′.1; top of dome of Cathedral, 108° 57′.1; top of dome of Iglesia de San Francisco, 133° 11′.2; lightning rod on Iglesia de L'Hermita, 150° 03′.5; top of right tower of Iglesia de Velen, 265° 28′.1.

Puerto Berrio, Antioquia, 1909.—South of the township, on flat top of a small hill about 100 feet (30 meters) high which was evidently once an island in the Magdalena River and is now occupied by the houses of the manager and another official of the Antioquian Railway. 24 paces from west edge of bank, 10 paces from east edge, and 101 paces from the southeast corner of wire fence around railway quarters. The true bearing of the gable end of railway manager's house is 210° 00′.8.

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COLOMBIA—*concluded.*

Puerto Wilches, Bolivar, 1909.—About 100 yards (91 meters) up the river from where the steamers moor, just below the temporary house of Mr. Pitt, of the Puerto Wilches Railway, and about midway between it and the river.

Riohacha, Magdalena, 1909.—Southwest of the town in open ground on top of very slight rise about 200 yards (183 meters) from the houses nearly on continuation of street running at right angles to the beach (the first street to the northeast from square containing church). Marked by wooden peg. The following true bearings were determined: cross on dome of church, 132° 51′.7; top of belfry of school, 181° 48′.3.

Santa Marta, Magdalena, 1909.—On open plain between city and semicircle of hills to north about one-third mile (0.5 kilometer) past railroad and near south end of a large patch of scrub in center of plain. Marked by a wooden peg. The following true bearings were determined: top of dome of Cathedral, 6° 37′.8; right-hand edge of custom house, 63° 42′.5.

Savanilla, Bolivar, 1908, 1909.—The station of 1908 was on a bank of clay and sand about 275 yards (251 meters) southwestward along the shore from the pier and about 6 feet (2 meters) from top of bank. The station of 1909 is about 60 feet (18 meters) farther from the pier than that of 1908. The following true bearings were determined from the station of 1909: lighthouse, 223° 18′.2; lighthouse, 149° 31′.1.

Tumaco, Cauca, 1909.—In an open grassy space on property of Mrs. Dwight, on the innermost or landward end of the island opposite Tumaco called Morrito or Morro Chico. Mrs. Dwight's house is distant about 250 yards (230 meters) northeast. The top of church tower in Tumaco is in true bearing 79° 26′.9.

ECUADOR.

Bahia, Manabi, 1908.—On top of narrow promontory on which the lighthouse stands, about 44 paces seaward of lighthouse.

Esmeraldas, Esmeraldas, 1908.—About a mile (1.6 kilometers) southwest of town, on road leading to Tiaune, at top of first steep rise in road and first from which any of the town can be seen; the road is lined on both sides by dense bush. Marked by a wooden peg. The top of tower of Cuartel was found in true bearing 231° 59′.2.

Guayaquil, Guayas, 1908.—Between the Cerro del Carmen and the Cerro de Santa Ana, west-southwest of the military hospital on a unused path through grounds of Mr. Riley, practically on ridge and 118 feet (35.0 meters) from west corner of board fence around hospital grounds. The following true bearings were determined: flagstaff on top of Cerro de Santa Ana, 277° 15′.5; center of tower of military hospital, 269° 27′.8; lightning rod on center chimney of pumping station, 331° 54′.1.

Hacienda Caucha, Esmeraldas, 1908.—On left bank of Esmeraldas River, below house of Sr. Tomaso Angulo, owner of Hacienda Caucha, about 3 miles (5 kilometers) above the village of Mafua and about three-fourths of the way up a long reach in the river just above Mafua. On soft sandstone rock and marked by wooden peg.

Ibarra, Imbabura, 1908.—On top of first hill to west of continuation of street to left of Iglesia de San Domingo, and north of and just outside the town. The following true bearings were determined: left tower of Collegio Nacional, 352° 38′.4; center of top

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ECUADOR—*continued.*

Ibarra, Imbabura, 1908—*continued.*
of tower of San Domingo, 345° 14′.8; top of center tower of Cathedral, 358° 10′.0; tower of church in village of San Antonio, 63° 57′.2.

Loja, Loja, 1908.—At foot of mountains and just south of and overlooking the city, on property belonging to Sr. José Maria Leguerica, and known as "Pucará." In the second field from Calle Bolivar, 105 feet (32.0 meters) from cactus hedge southeast, 107 feet (32.6 meters) from cactus hedge northeast, and is marked by peg of coffeewood. The following true bearings were determined: top of dome in cemetery, 97° 09′.2; statue of Virgin on opposite slope, 143° 01′.8; top of hospital tower, 161° 32′.7; top of large tower of Iglesia de San Francisco, 167° 45′.4; top of tower of Las Conceptas Cathedral, 168° 45′.5; top of tower of Iglesia del Carmen, 175° 20′.5.

Manta, Manabi, 1908.—Just outside the township and may be best reached by going up the beach past the township to first road leading into the interior; on top of small rise in an inclosed lot at left side of beginning of road near the stump of a small tree and about 2 feet (0.6 meter) to right of line from stump to hospital, about 60 paces southwest of gate in bamboo fence and 11 paces east of thorn fence along roadside. The outer edge of hospital bears 264° 31′.1.

Porto Velo, Oro, 1908.—At the South American Development Company's mines near Zaruma, on a small knoll on a ridge running southwest from the doctor's house, on ground covered with thin scrub; 25 paces below the first trail that crosses the ridge. Marked by a wooden peg. The west edge of doctor's house is in true azimuth 220° 01′.8.

Quito, Pichincha, 1908.—East of the city, on top of a hill called Ichimbia, which is also the name of the hacienda on which it is situated. A road runs along top of hill and station is reached by following this road 300 yards (274 meters) past the old farmhouse of Camilo Ponse and about 200 yards (183 meters) past a grove of eucalyptus trees, to a mud gateway on the east side of the road. The station is 20 feet (6.1 meters) east of the center of the gateway; there is a similar gateway on the west side of the road. The surrounding country is volcanic and there is considerable volcanic ash in the soil. The center of right-hand gable end of house erected by the French Commission for measuring arc of meridian, on hill to southwest, was found to be in true bearing 64° 51′.2.

Secondary dip observations were also made at house of Mr. Soderstrom about three-fourths mile (1.2 kilometers) west of station.

Riobamba, Chimborazo, 1908.—On the small hill about one-fourth mile (0.4 kilometer) north of railroad station. The hill is called Cerro del Quito and is reached by following the Carrera de Arozco and its continuation. On top of the hill is a brick pier with a wooden structure with four arms over it, probably put there by French Commission measuring arc of meridian. The station is 84½ feet (25.8 meters) southeast of this pier and 16 feet (4.9 meters) northeast of northeast corner of mud wall of an old Indian house. The station is on bare sandy soil and the region is surrounded by extinct and active volcanoes. The following true bearings were determined: top of tower of Cathedral, 319° 33′.1; brick pier, 143° 52′; cairn on top of prominent peak (Amula), 68° 01′.1.

Salinas, Guaymas, 1908.—Near office and quarters of cable staff of the Central and South American Development Company on Santa Elena Point, near the

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ECUADOR—*concluded.*

Salinas, Guaymas, 1908 —*continued.*
village of Salinas. Marked by wooden peg. The following true bearings were determined: lighthouse tower on Santa Elena Point, 130° 25′.4; flagstaff on cable office, 163° 25′.0; ornament on seaward end of gable of quarters, 243° 18′.5.

Santa Rosa, Guaymas, 1908.—In a field owned by Sr. Don José Segundo Paredes, about a mile (1.6 kilometers) out of Santa Rosa, on road which goes to Zaruma, and on southwest side of road. 71.5 feet (21.8 meters) east of an ebony tree, and 35 feet (10.7 meters) south of corner post of fence about an old Indian house. Marked by a wooden peg.

Tulcan, Carchi, 1908.—In large yard at back of houses on northeast side of main plaza of the town; 47 feet (14.3 meters) from northeast wall, and 48 feet (14.6 meters) from southeast wall of yard. The soil consists largely of highly magnetic volcanic sand. Tower of distant church of Carlosama bears 168° 03′.0.

GUIANA.

Albina, Dutch Guiana, 1908.—In an open lot about 100 yards (91 meters) north of post office and custom-house, 52 feet (15.8 meters) west of top of river bank, 60.8 feet (18.5 meters) southeast from southeast corner of small stone building, and 77.0 feet (23.47 meters) northwest of northeast corner of small frame building belonging to J. J. Smith. Marked by a stake. The following true bearings were determined: north gable of shed on Albina pier, 333° 39′.9; west end of shed on St. Laurent government pier, 252° 46′.2; east end of shed on St. Laurent government pier, 254° 03′.4.

Arakaka, British Guiana, 1908.—On the government reservation, near extremity of a promontory, at bend of river in front of hospital, near north side of strip cleared for a roadway along top of hill. 15.5 feet (4.72 meters) from center of trench around garden at north corner and 53 feet (16.2 meters) from center at east corner, 50 paces from east corner of hospital, 43 paces from foot bridge over trench at west end of hospital, and 33 feet (10.1 meters) from center of roadway leading down to warden's landing. Marked by an oak stake. The south edge of flagpole in front of warden's house is in true bearing 311° 56′.2.

Barima Mine, British Guiana, 1908.—In the path which passes to the east of the manager's house and north of the office, near a tall stump about 150 feet (46 meters) southeast of the manager's office.

Bartica, British Guiana, 1908.—At the hospital landing, on bank of river, nearly in front of the registration office of hospital, and at end of an avenue of large mango trees, 66 feet (20.0 meters) west of the last of trees along south side of road, 72 feet (21.9 meters) northwest of fence corner on west side of street, 116 feet (35.4 meters) northwest of fence corner on east side of street, 17 feet (5.2 meters) south of a native plum tree 4 feet (1.2 meters) in diameter, and 36.5 feet (11.12 meters) west of a sandbox tree 3 feet (0.9 meter) in diameter. The following true bearings were determined: north gable of hospital, 63° 03′.7; north gable of registration office, 18° 37′.7.

Brownsweg, Dutch Guiana, 1908.—At south end of a meridian line laid out by officers of the Dutch Navy in 1905, about 0.5 kilometer south of railway station. Stake marking north end of the meridian line is in true bearing 180° 00′.6.

SOUTH AMERICA.

GUIANA—*continued.*

Cayenne, French Guiana, 1908.—In a public roadway in the Botanical Gardens, in eastern portion of the town; 236.5 meters due south of garden gate, 9.8 feet (2.99 meters) east of edge of a ditch, and 31.5 feet (9.60 meters) west of edge of a ditch. Marked by a cluster of copper tacks in top of a wooden post 6 by 6 by 36 inches (15 by 15 by 91 cm.) projecting slightly above the ground. The east edge of the east pillar at the gate is in true bearing 167° 05′.4.

Frankville, British Guiana, 1908.—On the property of Mr. Frank Barnes, on the Corentyne River, nearly opposite the south end of McLennan's Island, in a cleared space just north of site on which a new sawmill is to be erected, and between the house occupied by Mr. Barnes and that occupied by the overseer.

Georgetown, British Guiana, 1908.—Near center of D'Urban race course, east of town and south of Botanical Gardens, in a graded roadway which crosses the course back of the "Round Stand." 81 paces south of the annex to the round stand, 37 paces from the drainage canal along inner edge of course to the south, 10 feet (3.0 meters) from center of ditch along east side of roadway, and 22 feet (6.7 meters) from center of ditch on west side of roadway. Marked by a seasoned post 6 by 6 by 24 inches (15 by 15 by 61 cm.) marked C.I.1908 and projecting about 2½ inches (6 cm.) above ground. The following true bearings were determined: spire on Catholic Church, 105° 11′.5; ball below weather vane on Botanical House, 128° 34′.5; south gable of round stand, 194° 57′.5.

Groningen, Dutch Guiana, 1908.—In an open space on west side of road in rear of hospital, 38 paces from gate of hospital grounds (measured at right angles to fence), 34 paces southwest of nearest corner of a row of sheds, and 7 paces to right of center of road running from police station to quarantine hospital west of landing. The spire on the Moravian Church is in true bearing 33° 08′.2.

Île Royale (Îles du Salut), French Guiana, 1908.—On the southeastern side of the island, 84.5 feet (25.76 meters) southeast from the southeast corner of present coal shed, 172 feet (52.4 meters) from the southwest corner of the old portion of the coal shed, and 38 feet (11.6 meters) from outer edge of sea wall. This point is probably not very far from the station of Harkness in 1865. The following true bearings were determined: post supporting tide gauge on St. Joseph Island, 341° 46′.6; nearer rod supporting a red light on end of a breakwater, 47° 01′.8; corner of coal shed formed by southwest and southeast faces, 160° 54′.1; outer edge of sea wall on northwest side of St. Joseph Island, 290° 07′.6. Declination was also observed at a point, designated as B, 50 feet (15.2 meters) nearer the coal shed.

Kaieteur Falls, British Guiana, 1908.—On open plain near head of falls, about 100 yards (91 meters) from where path leaves forest, and a few feet within the fork of the path formed by one branch leading to a boat landing and camping place above the falls, and another to a point below, from which the falls may be observed.

Kangaruma, British Guiana, 1908.—Just above Pakatuk cataract and about 8 miles (13 kilometers) from Potaro Landing, near storehouse and camp of a rubber company. In clearing just above a few Indian huts, 12 feet (3.7 meters) south of center of path, and 88 feet (26.8 meters) from nearest corner of storehouse, the east side of which produced passes 9 feet (2.7 meters) west of station.

SOUTH AMERICA.

GUIANA—*continued.*

Malali, British Guiana, 1908.—On grounds of Malali Mission, on opposite bank of river from police station and boat landing, in an open space southwest of Mission House and northeast of chapel, 73.0 feet (22.25 meters) from southwest corner of Mission House, 88.5 feet (26.97 meters) from southeast corner, 46 feet (14.02 meters) from the nearer of two tall posts which stand on either side of path through garden in front of house, and 32 feet (9.8 meters) from the path at its nearest point. Two large mango trees about 20 paces apart are distant 44 and 38 paces respectively southwest and south. The following true bearings were determined: southeast corner of chapel, 25° 22′.6; east gable of schoolhouse, 312° 51′.5; southeast corner of porch at Mission House, 238° 17′.1.

Morawhanna, British Guiana, 1908.—On a dike which is used as a footway, and along which the few cottages of the place are built, near south end of a dam of piles and planks; 3 feet (0.9 meter) north and 3 feet (0.9 meter) east of south end of dam, and about 250 feet (76 meters) from end of walk leading to pier in front of store. Marked by a stake.

Mount Everard, British Guiana, 1908.—At the terminus of steamer service from Georgetown and of launch service from Arakaka, at foot of hill known as Mount Everard, near Barima River, at intersection of two paths; 33 paces from ditch south of dike and 62 paces from nearest corner of kitchen at rear of store and hotel. Gable of police station building is in true bearing 210° 23′.7.

New Amsterdam, British Guiana, 1908.—North of city, on grounds of the lunatic asylum and near northeast corner of large quadrangle used as a playground; 73 feet (22.3 meters) south-southeast of a 24-inch (61 cm.) tree, 28.5 feet (8.7 meters) west-northwest of a 12-inch (30 cm.) mango; 34.5 feet (10.5 meters) northwest of a 20-inch (51 cm.) tree, 49.5 feet (15.1 cm.) from an 18-inch (46 cm.) tree in corner of tract, and 110 feet (33.5 meters) northwest of nearest corner of superintendent's residence. Marked by a wooden post 6 by 6 by 24 inches (15 by 15 by 61 cm.) set flush with the ground and lettered C.I.V111 by copper nails driven in top. The following true bearings were determined: outer corner of northwest foundation pier of Victoria Block, 72° 17′.3; northeast corner of stockade, 12° 43′.2; tip of water tank No. 3, 342° 56′.9; southeast corner of building on asylum grounds, 163° 01′.3.

Nieuw Klarenbeek, Dutch Guiana, 1908.—On the dike in front of banana estate called Nieuw Klarenbeek, opposite Charlottenburg, at base of embankment, about 10 feet (3 meters) south from path along its top, and about 36 feet (11 meters) east of center of main walk from manager's house to landing. Spire of a small chapel on right bank of Cottica River, in Charlottenburg, is in true bearing 192° 41′.4.

Onverwacht, Dutch Guiana, 1908.—At the village on railway, about 30 kilometers south from Paramaribo station, in a clearing made for a path into forest (this path runs at right angles to main path from a point about 125 yards (115 meters) west of railway track), in center of branch path, about 75 feet (23 meters) north of center of main path, and about 25 feet (8 meters) south of line of forest.

Oreala, British Guiana, 1908.—On grounds of Oreala Mission, near top of bank in front of house occupied by the Mission catechist, 11 paces northeast of northeast corner of house, and 40 paces northwest from northwest corner of schoolhouse, east of a small oleander bush and west of a large cactus.

SOUTH AMERICA.

GUIANA—*continued.*

Paramaribo, Dutch Guiana, 1908.—Near river, east of city, on a tract of ground used as a cricket field and immediately at left of target range. 12 feet (3.7 meters) from edge of ditch on north, and 109 feet (33.2 meters) from edge of ditch to southwest; the nearest corner of the clubhouse is 120.5 feet (36.73 meters) nearly west. Marked by a brass bolt in top of a hardwood post 6 by 6 by 24 inches (15 by 15 by 61 cm.) set nearly flush with ground, the top being painted white with letters C. I. 1908 in black. The following true bearings were determined: left cross on Catholic Church, 86° 32′.6; east gable of Public Works Shop, 54° 13′.1; east gable of garrison magazine, 45° 28′.8; gable of house of District Commissary of Police, 95° 07′.8

Potaro Mission, British Guiana, 1908.—On grounds of Potaro Mission, in center of space surrounded by the catechist's quarters, the chapel, some Indian huts, and the "mission house." The Mission is on a hill a short distance up the river from Potaro Landing.

Regina (Approuague), French Guiana, 1908.—In path along river bank, about 50 paces north of steamer landing, at the small settlement known as Regina.

Rockstone, British Guiana, 1908.—On an open space on bank of a small creek and about 150 feet (46 meters) southwest of hotel.

Saint Jean, French Guiana, 1908.—On brow of hill, 43 paces east of official street, 98 paces north of school building, and about 15 paces west of west wall of school produced. Marked by a deep hole in center of cement pyramidion on top of a brick pillar 75 cm. high and 50 cm. square. The following true bearings were determined: outer edge of brick pillar under northeast corner of balcony about officers' quarters, 6° 44′.5; gable of engine house at brick plant, 186° 19′.2; tip of bell house, 329° 42′.5; north gable of hospital (upper part), 109° 04′.8.

Sault Hermina, French Guiana, 1908.—On an island in the Maroni River, about a mile (2 kilometers) above Apatoe landing. This island is one of a chain extending across the channel and is probably under water during the rainy season; there is a settlement opposite on the Dutch bank of the river.

Springlands, British Guiana, 1908.—On the beach just above high-water mark and about 150 feet (46 meters) north of pier. The southwest corner of shed on the pier is in true bearing 292° 01′.4.

Suddie, British Guiana, 1908.—On the dike between the sea and the residence of the police inspector, about three-eighths mile (0.6 kilometer) north of steamer pier. 17 feet (5.2 meters) north of north line of inspector's residence, about 80 feet (24 meters) south of south line of jail yard, and about 100 feet (30 meters) south of a large tree on the dike. Marked by a stake. The tip on cupola of barracks is in true bearing 126° 59′.0.

Tumatumari, British Guiana, 1908.—Near house of warden of lands and mines, in path leading from house to west gate, about 55 feet (17 meters) from northwest corner of house, about 60 feet (18 meters) from center of foot of stairway at front entrance and about 50 feet (15 meters) from west gate; two palm trees about 49 feet (15 meters) apart stand east and northeast at distances 28 feet (8.5 meters) and 60 feet (18.3 meters) respectively. Marked by a stake.

Wismar, British Guiana, 1908.—On a hill just west of steamer landing and railway station, near and south of house occupied by the superintendent of the rail-

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GUIANA—*concluded.*

Wismar, British Guiana, 1908—*continued.*
way, over stump of a hardwood tree near and west of path which leads from superintendent's house to public path at foot of hill. 85 feet (25.9 meters) southeast of a large tree, 23 feet (7.0 meters) northwest of a large stump, 83 feet (25.3 meters) southwest of a telegraph post, and 165 feet (50.3 meters) south from nearest corner of house. Marked by a cross cut in top of stump. The west gable of the roof over the steamer landing is in true bearing 266° 20′.0.

PERU.

Amazon 17, Lorcto, 1910.—On northeast bank of river, just opposite the first island above Leticia, the official frontier post of Peru, on a small sand bar about 30 yards (27 meters) nearer the river than the high water shore line.

Amazon 18, Lorcto, 1910.—On sand bar near north bank of river and about midway between the two high-water banks of river.

Amazon 19, Loreto, 1910.—On a mud flat on north bank of river, a few paces below a sand bar formed at the mouth of a tributary which extends towards the northeast; marked by a stake projecting 5 inches (13 cm.) above surface of ground.

Avispa, Loreto, 1910.—On a large bar in bend near mouth of Tapichi River and about midway between towns of Avispa and Reguena; about 65 feet (20 meters) southwest from inlet where steamers stop to unload, and about 50 feet (15 meters) from river shore. Looking across the inlet the bluff, or old shore line, is about 200 feet (61 meters) northeast.

Cantumayo (*Cantamana*), *Loreto*, 1910.—Near Janitos Trading Company's steamer landing, in an open space between main street and river, about 140 feet (43 meters) southwest of large store, 90 feet (27.4 meters) south-southwest from a flagpole in front of large store, 60 feet (18.3 meters) north from high-shore line, and 40 feet (12.2 meters) southeast of a large shade tree. The flagpole in front of the large store is in true bearing 235° 42′.6.

Condor Conqui, Lorcto, 1910.—On a shelf halfway up the river bank and directly in path leading from landing to level ground above.

Delicia, Loreto, 1910.—In path leading from landing to house at the farm called Delicia, on northeast bank of Ucayali River, about 200 yards (183 meters) from house, 8 feet (2.4 meters) from river bank, and 21 feet (6.4 meters) north of a rail fence extending from river toward house.

Filadelfia, Loreto, 1910.—On northeast shore of Ucayali River in the clearing near house of farm called Filadelfia, about 100 yards (91 meters) southwest of house, directly in path to canoe landing, 50 feet (15.2 meters) from river shore, and 120 feet (36.6 meters) west of fence which extends from river bank to garden fence around house.

Iquitos, Loreto, 1910.—On a small plateau of river bank between river and street, 40 feet (12.2 meters) north of a small inlet, 15 feet (4.6 meters) west of river, about 100 yards (91 meters) from street level and about 130 yards (119 meters) from building of the iron works, directly below the Bellevista Cafe. Marked by a wood stake 1½ inches (4 cm.) in diameter set flush with ground.

Masisea, Loreto, 1910.—On east shore of Ucayali River near steamer landing of first farm above Masisea, 25 feet (7.6 meters) west of a row of trees along

SOUTH AMERICA.

PERU—*concluded.*

Masisea, Loreto, 1910—*continued.*
shore, and 14 feet (4.3 meters) north of path leading from river to row of houses about 400 yards (366 meters) back of river. The dip circle observations were made at steamer landing of town of Masisea.

Nauta, Loreto, 1910.—On the high bank on northwest side of river and about 150 yards (137 meters) in front of house which is nearest canoe landing; directly in path leading from canoe landing to house, 10 feet (3.0 meters) from edge of high bank of river, and 50 feet (15.2 meters) northeast from point where path gains high level.

Petronela, Loreto, 1910.—On the north ashore of Ucayali River on farm called Petronela, in path which runs parallel to river between shore and small mountain, 15 feet (4.6 meters) from path from river to house, 8 feet (2.4 meters) from edge of steep bank, and about 80 feet (24 meters) west-northwest of a small inlet. The dip circle observations were taken one-fourth mile (0.4 km.) up stream from main station, at the point where steamers discharge cargo for Cauchawaya.

San Jorge, Loreto, 1910.—In a large clearing between town and river, 35 feet (10.7 meters) from river's edge, 90 feet (27.4 meters) northeast of path leading from landing to largest house, and 450 feet (137.2 meters) from that house.

San Lorenzo Island, (Callao Harbor), Lima, 1908.—The main station is about 5.5 feet (1.7 meters) above and about 50 feet (15 meters) distant from the ordinary high-water mark on the beach, and is approximately the U. S. Coast and Geodetic Survey station of 1907. It is 79 feet (24.1 meters) and 67.4 feet (20.54 meters) from the northeast and southeast corners of the powder magazine (marked "deposito de explosives") which are in true bearing north 68°.7 west and south 34°.1 west respectively, and 57.5 feet (17.5 meters) from door of magazine directly beneath flagstaff. The point is marked by a small round stake driven flush with ground. The following true bearings were determined: square tower with clock in Callao, 250° 31′.0; spire of church on point in Callao, 256° 00′.7. A secondary station designated as San Lorenzo Island 2 was established at a point south 31° east true 52.5 feet (16.0 meters) distant from main station.

Sempaya, Loreto, 1910.—On a sand bar in a bend near the east shore of the Ucayali River.

Sheshea, Loreto, 1910.—On the east shore of the Ucayali River in front of the house occupied by owner of farm called Sheshea, about 90 feet (27 meters) west of the house, 8 feet (2.4 meters) east of where the ground slopes toward the river, and 3 feet (0.9 meter) from the path which leads from the shore to the house. Marked by a small wood stake set flush with ground.

Yurimaguas, Lorcto, 1910, 1911.—Station 1 of 1910 is between the river and the first street of the town, 18.7 meters south of walk leading from river to town and about 25 meters from river bank. A local disturbance being indicated, a second station, II, 76 meters north of Station I, was occupied in 1911. Marked by a small stake set even with ground.

VENEZUELA.

Carácas, Federal District, 1905.—On hill upon which astronomical observatory stands, 63.2 feet (19.26 meters) distant to northwest of the northwest corner of observatory. A large boulder is 40.9 feet (12.47 meters) to the southwest, and a pier for mounting an

SOUTH AMERICA.

VENEZUELA—*concluded.*

Carácas, Federal District, 1905—*continued.*
instrument is 33.6 feet (10.24 meters) to the south-southeast. Marked by a marble post, rhomboidal in cross-section, being 3.5 by 6 by 27 inches (9 by 15 by 69 cm.) in dimensions, and set so as to project about 2 inches (5 cm.) above ground; top lettered C.I.1905 with a small hole at center. The east spire of the Pantheon Nacional is in true bearing 240° 15′.6.

ISLANDS, ATLANTIC OCEAN.

BERMUDAS.

Agar's Island, 1907, 1910.—The principal C.I.W. station, A, is near the southwestern extremity of the island, about 150 feet (46 meters) from western extremity of spur extending westerly toward Two Rock Passage, about 35 feet (11 meters) from the south shore line and about 60 feet (18 meters) from north shore line. The spur is separated from main part of island by a shallow cove. Station marked by a native coral stone post 18 inches (45 cm.) long, projecting about 6 inches (15 cm.) above general surface; the projecting portion is squared to 10 by 10 inches (25 by 25 cm.) and covered with a very thin layer of cement, in which the diagonals are marked, the intersection of the diagonals defining the precise point. The following true bearings were determined: Gibbs Hill lighthouse, 27° 51′.6; clock (left) tower at the dockyard, 146° 40′.9; flagpole at Port's Island (naval quarantine), 43° 32′.3. An auxiliary station was established in 1910, 106.3 feet (32.4 meters) almost due west of the principal station near extremity of projecting point of rock.

A secondary station, B, was established in 1907 about 25 feet (8 meters) from main station in the direction of lighthouse.

Ireland Island, 1907.—Station is at western side of island on tract which has been leveled and is now designated as Moresby's Plain, near center of a low square mound surrounded by a rude stone coping, about 10 feet (3 meters) square and 10 inches (25 cm.) high, formerly used as a firing point in rifle practice; a similar mound is about 15 yards (14 meters) further south, and a much larger and newer platform marked "911 yards" is 52 feet (15.8 meters) measured to the nearest corner northward. The following true bearings were determined: spire of Somerset Church, 46° 51′.6; signal mast at fort, 242° 07′.0.

Nonsuch Island, 1907.—The new station established in 1907 is at a point near the western extremity of the island 30 or 40 rods (about 150 meters) west of E. D. Preston's station of 1890; just west of the limit of a patch of dense low bushes, on crest of ridge, about 35 feet (11 meters) from edge of steep bank on north, and 150 feet (46 meters) from edge of bank to south. Marked by a coral stone about 8 by 10 inches (20 by 25 cm.) at the top, set so as to project slightly above the surrounding coral rock into which it was set. The following true bearings were determined: flagstaff at Fort George, 156° 11′.7; Martello tower, west edge, 110° 35′.3; pilot mast at Tuckerstown, 57° 33′.7. A second station, practically the same as E. D. Preston's station of 1890, was also occupied. It is probably 6 feet (2 meters) south of Preston's Point, 80 feet (24.4 meters) northwest of flagpole, 56 feet (17.1 meters) from northwest corner of new kitchen, 100 feet (30.5 meters) from the northwest corner of men's ward, 22 feet (6.7 meters) from edge of path to landing, and 67 feet (20.4 meters) from southeast corner of keeper's house. The bearing of St. Davids lighthouse is 212° 50′.0.

ISLANDS, ATLANTIC OCEAN.

BERMUDAS—*concluded.*

St. George, 1907.—Station is north of town, on a triangular tract of land belonging to the colony, lying between the poorhouse on the west and military lands to the east, bounded on the east by a deep-cut road leading straight to center of town, on the northwest by a by-road running northeasterly, and on the south by the edge of the hill overlooking a larger tract covered with a grove of large cedars. The station is 26 feet (7.9 meters) west of the sunken road and 70 feet (21.3 meters) southwest of a boundary stone standing east of that road, which is about 10 feet (3 meters) wide. Marked by a coral stone 8 by 10 by 16 inches (20 by 25 by 41 cm.), the precise point in the top being marked by driving in brass nails. The following true bearings were determined: St. Davids lighthouse, 311° 25′.4; southeast corner of Hotel St. George, 4° 19′.0; the flagmast at Fort Victoria, 242° 24′.9.

Spectacle Island or Hunt's Island, 1907, 1910.—Station is near center of western part of island, in a low circular opening among trees where the soil is unusually deep; there are trees about 25 feet (8 meters) to the east and a clump of bushes 12 feet (4 meters) to the west. Two large cedar trees stand, one 18 feet (5.5 meters) to the south, and the other 22 feet (6.7 meters) southwesterly. The bare rock is about 12 yards (11 meters) to the north through bushes, and about twice as far to the south. The shore on the south is very flat, so that distance to water varies greatly with the tide. Marked by a cedar post set about 20 inches (50 cm.) in the soil and projecting slightly above surface with top marked by the letters C.I., made by driving in brass nails. The following true bearings were determined: clock tower at dockyard, 180° 34′.5; left edge of tank at north end of Boaz Bridge, 159° 18′.3; vane on the lighthouse, 351° 25′.5. An auxiliary station 34.55 feet (10.53 meters) south of principal station, in exact line with clock tower at dockyard, was also occupied in 1910. A secondary station, B, was established in 1907 about 30 feet (9 meters) north of main station.

MADEIRAS.

Funchal, 1909.—The main station, designated as A, is near center of parade grounds of College Barracks and as close as could be determined to station of Capt. F. A. Chaves, 1903 and 1906. The Cathedral spire is in true bearing 315° 16′.4. The secondary station, designated as C, is on point west of Funchal, about one-eighth mile (0.2 kilometer) east of new fish cannery, on a level bluff about 60 feet (18 meters) above water and about 15 feet (4.5 meters) back from beach. Sail Rock is in true bearing 277° 16′.3. Auxiliary stations were established at both of these points and showed considerable local disturbance; B was 40 feet (12 meters) from A, and D was 42.5 feet (13 meters) from C.

WEST INDIES.

Basse Terre, Guadeloupe, 1905.—In northwestern part of town, about a mile (1.6 kilometers) from the wharf and in the northwestern corner of the Public Garden, about 250 feet (76 meters) almost due north of the gardener's office and about 50 feet (15 meters) from the stone wall to the northwest. Marked by block of stone 12 by 12 by 6 inches (30 by 30 by 15 cm.) set in a bed of stone and cement, and flush with surface of ground; the top is lettered C.I.1905, and a hole at the center indicates the precise point. The west corner of gardener's office is in true bearing 6° 19′.3.

ISLANDS, ATLANTIC OCEAN.

WEST INDIES—*continued.*

Basse Terre, St. Christopher, 1905.—In northwestern part of city about 0.5 mile (0.8 kilometer) from the wharf, in the northwestern part of the Botanical Garden, on a slight elevation about 250 feet (76 meters) west by north from the gardener's office. Marked by a reddish brown stone 4 by 4 by 30 inches (10 by 10 by 76 cm.) set so as to project about an inch (3 cm.) above the general surface and lettered on top C.I.1905, with a small drill hole at the center. The following true bearings were determined: signal station 30° 30′.9; flagpole at Mayor's house, 164° 41′.3.

Batabano, Cuba, 1905.—Near center of a tract of open ground lying between the two parts of town, about 300 to 400 yards (275 to 350 meters) west of the railroad tracks; 114.3 feet (34.84 meters) northwest of a concrete pillar extending 1 foot (30 cm.) above the surface of the ground, and marking the boundary between the city property and the railroad property. Marked by a cement post 6 by 6 by 30 inches (15 by 15 by 76 cm.) set so as to project 2 inches (5 cm.) above the surface of the ground, and having a drill hole in the top. The following true bearings were determined: southwest corner of west dock building, 338° 43′.7; the southeast corner of Hotel Miramar, 262° 58′.8; landmark, cement pillar near seashore, 340° 27′.6.

Bathsheba, Barbados, 1908.—On a flat table immediately in front of Beachmount Hotel, very nearly in line of west side of hotel produced, in west corner of an area that has been leveled for a playground.

Bridgetown, Barbados, 1905, 1908.—The station of 1905 was in the old Naval Hospital grounds, just northeast of the Marine Hotel, 32 feet (9.8 meters) from stone wall along the west, and 39.4 feet (12.01 meters) from stone wall along south border of the grounds. It was marked by small drill hole in top of a stone post 8 by 12 by 30 inches (20 by 30 by 76 cm.), lettered "C.I.1905." The 1905 station was recovered in 1908 but found unsuitable for reoccupation, owing to local artificial disturbance. The 1908 station was established about 300 feet (91 meters) southeast of the old station at a point 26.8 feet (8.17 meters) nearly north of the Transit of Venus pier, and 121.8 feet (37.12 meters) west of an inside corner in the stone wall along east boundary of grounds. It is marked by drill hole in top of a limestone post 6 by 10 by 20 inches (15 by 25 by 51 cm.) marked C.I.1908 and projecting slightly above ground. The following true bearings were determined: tip on bandstand (The Rocks), 27° 41′.0; flagpole on Sea View Hotel, 93° 27′.6. Secondary stations B and C were established in 1908. B is 107 paces northeast of main station in range with main station and tip of bandstand. C is on the brink of the hill, 83 paces from the main station and 16 feet (4.9 meters) from west boundary wall, in range between main station and flagpole on Sea View Hotel, and about 85 feet (26 meters) south and 56 feet (17 meters) east of 1905 station.

Cardenas, Cuba, 1908.—On slight rise of ground in southern part of town, about 200 yards (183 meters) northeast of baseball park, 350 yards (320 meters) south of monument to Cuban patriots slain in war, 207 feet (63 meters) southwest of the western corner of old church, 43 feet (13 meters) from intersection of two roads, and about 70 feet (21 meters) south of large gully. Marked by slab of marble about 2.5 by 5 by 20 inches (6 by 13 by 51 cm.) projecting about 2 inches (5 cm.) out of ground and lettered on top

ISLANDS, ATLANTIC OCEAN.

WEST INDIES—*continued.*

Cardenas, Cuba, 1908—*continued.*
C.I.1908. The station center is period after the C. The apex of monument to Cuban patriots is in true bearing 170° 38′.5.

Charlestown, Nevis, 1905.—In the northwestern corner of a field on what is known as the Story Grove Sugar Estate, about one-half mile (0.8 kilometer) south of town and about one-quarter mile (0.4 kilometer) due north of the old bath house. Marked by a large stone set 18 inches (46 cm.) in the ground, the top being triangular shaped; this stone is unmarked, but it is the only one showing conspicuously in this part of the field. The following true bearings were determined: smokestack of sugar mill, 282° 04′.6; church spire, 332° 11′.8.

Charlotte Amelia, St. Thomas, 1905.—About 1 mile (1.6 kilometers) due east of town on the grounds of an old sugar estate, and to the west of the ruins of an old house. It is 70.5 feet (21.50 meters) from the northwest corner of this ruined building and about 30 feet (9.1 meters) from a stone wall along the south of the lot. Marked by a cement post 4 by 6 by 27 inches (10 by 15 by 69 cm.) set so as to project about 3 inches (8 cm.) above the surface of the ground; top is lettered C.I.1905 with a small hole at the center. The following true bearings were determined: signal station at Fort Cowell near entrance to harbor, 53° 32′.4; weather bureau station, 81° 50′.1; Blue Beard's Castle, 97° 03′.2.

Christiansted, Ste. Croix, 1905.—Near wharf in the midst of a grass plot used as a park northwest of the old fort now used as police headquarters, in a group of cocoanut trees. Marked by a sandstone post 28 inches (70 cm.) long and about 4 by 6 inches (10 by 15 cm.) at top, set flush with ground and lettered C.I.1905. The precise point is near center of the 9. The New Fort lighthouse is in true bearing 222° 58′.2.

Cienfuegos, Cuba, 1908.—North of the city, on the highest part of a round knoll about 300 yards (274 meters) northwest of Caonao Road and almost opposite the 3-kilometer stone. The station is 20 yards (18 meters) west of a small thorn bush and marked by a marble slab 2 by 4 by 21 inches (5 by 10 by 53 cm.) projecting about 2 inches (5 cm.) out of ground and lettered on top C.I.1908, the period after the I marking center of station. The following true bearings were determined: spire of Cathedral of Cienfuegos, 58° 55′.8; northernmost of two turrets on Cruces y Camaronea, 53° 49′.2.

Codrington, Barbuda, 1905.—In northeast corner of yard about administrator's house, 29.4 feet (8.96 meters) from nearest corner of a small stone structure and 30 feet (9.14 meters) north of a wire fence. Marked by a large stone having shape of a frustum of a cone, being about 2 feet (0.6 meter) long and about 10 inches (25 cm.) in diameter at the top, flush with the general surface and covered over with cement in which the letters C.I.1905 are marked; a small hole at center marks precise point.

Crocus Bay, Anguilla, 1905.—In northeastern corner of courthouse grounds, 69.5 feet (21.8 meters) nearly north of northeast corner of courthouse, 35 feet (10.67 meters) south of stone wall along north boundary, and 48.5 feet (14.78 meters) southeast of the southeast corner of the post office. Marked by a cement post 4 by 6 by 24 inches (10 by 15 by 61 cm.) set so as to project about an inch (3 cm.) above general surface. The schoolhouse spire, about a mile distant (1.6 kilometers), is in true bearing 265° 47′.9.

ISLANDS, ATLANTIC OCEAN.

WEST INDIES—*continued.*

Fort de France, Martinique, 1905.—In Military Hospital grounds in the northwestern part of the town, in the small open space to the southwest of the doctors' offices and about 75 feet (23 meters) west of the main walk leading to them. Marked by a dark grayish stone 6 by 8 by 28 inches (15 by 20 by 71 cm.) set so as to project an inch (3 cm.) or more above the general surface and having its top, which is a little aslant, lettered C.I.1905, with a small hole marking the precise point. The Calvary Chapel is in true bearing 272° 23′.1.

Gibara, Cuba, 1909.—In western part of town, in middle line of Calle N. Lopez, at its intersection with Calle Leiva, 70 feet (21 meters) south of southeast corner of first house (painted blue) on west side of Calle Leiva, 36 feet (11 meters) northeast of northern end of tumbledown wall between a good house and the ruins of an old house, 33 feet (10 meters) north of the northeast corner of ruined house. Marked by intersection of two lines cut in top of tent peg. The center of round projection on east gable of blockhouse is in true bearing 137° 53′.0.

Grand-Bourg, Marie Galante, 1905.—In public square about 100 feet (30 meters) north by east of the mayor's office and post office, about 500 feet (152 meters) east of the courthouse, and 25.5 feet (7.77 meters) south of the south edge of road to hospital. Marked by a rectangular stone post 6 by 10 by 24 inches (15 by 25 by 60 cm.) set on the solid rock 22 inches below surface and fixed in place with mortar and stones about the base; the top of stone projects about 2 inches (5 cm.) above the general surface and is lettered C.I.1905, with a small drill hole at the center. The following true bearings were determined: Catholic Church spire, 237° 25′.0; northeast corner porch post of courthouse, 129° 35′.9.

Guayabal, Cuba, 1909.—About 550 yards (503 meters) west of railroad, at north edge of a slight rise of ground near the seashore, 200 yards (183 meters) west of a wire fence and 20 feet (6 meters) south of a small tree. Marked by intersection of two lines cut in top of a pine stake 2 by 2.5 by 18 inches (5 by 6 by 46 cm.) projecting 2 inches (5 cm.) above ground. The west gable of Sr. Seandino Garcia's house, which is the largest of three houses west of the Francisco Sugar Company's wharf, is in true bearing 297° 44′.0.

Havana, Cuba, 1905, 1908.—Two stations, identical with the U. S. Coast and Geodetic Survey stations of 1903, designated as Havana, College, and Havana, villa, were occupied. The college station (not observed at in 1908) is the absolute observing house of the magnetic observatory at the Colegio de Belen. The villa station is in the suburbs of Havana, about 3 kilometers south of the College station, at the villa Asuncion de los Jesuites. Marked by intersection of three lines in top of concrete observing pier, about 100 paces west of seismic observatory. The spire on Belen College Church is in true bearing 179° 52′.8.

Jucaro, Cuba, 1909.—West of the town, about 600 yards (549 meters) west-northwest from railroad station, 107.5 feet (32.8 meters) east of northeast corner of cemetery, 58½ feet (17.8 meters) east of center of southeast end of foot bridge across large ditch or drain running along northern edge of cemetery on south bank of ditch. Marked by intersection of two lines cut in top of a stake 2 by 4 by 18 inches (5 by 10 by 46 cm.) projecting 1½ inches (4 cm.) out of ground. The north gable of railroad station is in true bearing 285° 46′.8.

ISLANDS, ATLANTIC OCEAN.

WEST INDIES—*continued.*

Kingston, Jamaica, 1905, 1908.—About 2 miles (3 kilometers) west of city, on farm owned by the Misses Perry, about 250 feet (76 meters) from the seashore and almost due north of Port Royal, on the Kingston side of the harbor. Marked by a 6 by 6 by 30 inch (15 by 15 by 76 cm.) stone set to project slightly above ground and marked "U. S. C. & G. S. 1905"; a drill hole indicates the precise point. The true bearing of Commodore's Lookout Tower at Port Royal is 29° 25′.2.

Kingston, St. Vincent, 1905.—In grounds of Agricultural Experiment Station, just north of post office and public offices; in grass plot, 127.4 feet (38.80 meters) east of southeast corner, and 157.4 feet (48.0 meters) southeast of northeast corner of boys' dormitory. Marked by a large stone 12 by 12 by 24 inches (30 by 30 by 60 cm.) set so as to project 1 inch (3 cm.) above the general surface, its top lettered C. I. 1905 with a small hole at center. The following true bearings were determined: east corner of Mr. Richards's house, 0° 28′.0; flagstaff on Mr. Corea's house, 353° 18′.8.

Le Moule, Guadeloupe, 1905.—In center of town, on public square, west of the market and a little to northeast of the front of the Catholic Church; 34.7 feet (10.58 meters) west of east boundary of the square; 30.2 feet (9.20 meters) north of nearest edge of walk, south side; 50.3 feet (15.3 meters) from northeast corner, and 83.2 feet (25.4 meters) from southeast corner of Catholic Church. Marked by a rectangular limestone post 6 by 12 by 32 inches (15 by 30 by 80 cm.) set flush with the ground and lettered on top C.I. 1905.

Macagua, Cuba, 1908.—About 400 yards (366 meters) southwest of railroad station, about 100 yards (91 meters) north of ruins of a small blockhouse, 129 feet (39 meters) southwest of northwest corner of Señor Betrana's house, and 29 feet (9 meters) from a small tree which stands between a large gully and the road leading from the village to the sugar mill. Marked by 0.5 inch (1 cm.) hole drilled in top of a soft stone post taken from ruins of blockhouse and set flush with ground. The flagpole on railroad statoin is in true bearing 166° 36′.3.

Manzanillo, Cuba, 1909.—East of town, on San Jose road, about 0.5 mile (0.8 kilometer) southeast of quarters of rural guard, in eastern corner of cleared space to southeast of Sr. Regutillo's house, 121 paces southeast of south corner, 110 paces northeast of San Jose road, 70 paces southwest of large tree, and 32 paces northeast of path leading to Cuban huts to east. Marked by a half-inch (1 cm.) hole drilled in top of soft flat stone buried flush with ground and covered with smaller stones. The following true bearings were determined: northeast corner of Casa Salud Colonia Española, 91° 57′.8; flagpole on quarters of rural guard, 117° 14′.2; eastern gable of hospital, long yellow building, 134° 38′.6.

Matanzas, Cuba, 1905.—Two stations, designated as A and B, were occupied. Station A is practically that established in 1879 by the U. S. Coast and Geodetic Survey. It is in the eastern circle of the public promenade known as the Paseo de Marti. Owing to electric car and other disturbances this point is not suitable for further occupation. Station B is on the grounds of the Hermitage of Montserrate, about one mile (1.6 kilometers) northwest of the city, on a high hill. It is located back of the chapel, 82.7 feet (25.20 meters) west-southwest of the southwest corner, and 99.5 feet (30.33 meters) southwest of the northwest corner, and 11.5 feet (3.50 meters) north of stone

ISLANDS, ATLANTIC OCEAN.

WEST INDIES—*continued.*

Mantanzas, Cuba, 1905—*continued.*
wall bounding grounds on the south. Marked by a cement post about 6 by 6 by 20 inches (15 by 15 by 51 cm.) lettered on top C.I.1905, and having small drill hole in center. The following true bearings were determined: southeast tower, church of St. Peter, 290° 43′.3; southwest tower, church of St. Peter, 291° 10′.1; central and highest tower of church of San Carlos, 316° 10′.1.

Nuevitas, Cuba, 1909.—In northwest part of baseball grounds on foundation where a house once stood, 110 paces northwest of center of front of grandstand, 60 paces southwest of northern corner of park, and 16 paces southeast of wood. Marked by intersection of two lines cut in top of a stake driven almost flush with ground.

Philipsburg, St. Martin, 1905.—In the schoolhouse grounds, 70 feet (21.3 meters) and 75 feet (22.9 meters) from the southwest and northwest corners of the west annex to the schoolhouse respectively, and 49 feet (14.9 meters) north of the wooden fence by which the lot is surrounded. Marked by a hardwood post, 6 by 4 by 30 inches (15 by 10 by 76 cm.) set so as to project about an inch (3 cm.) above the general surface, with a copper nail indicating the precise point. Fort Amsterdam is in true bearing 45° 44′.1.

Pinar del Rio, Cuba, 1905.—On grounds of large government office building, which is on highest eminence just at northwest edge of city, 89.8 feet (27.37 meters) northeast of northeast corner of government building. Marked by a cement block 6 by 6 by 30 inches (15 by 15 by 76 cm.) set so as to project slightly above surface of ground and having a drill hole in top and lettered C.I.1905. The following true bearings were determined: water tank pipe, 136° 36′.7; west upright in south side of railway bridge, 296° 49′.3.

Placetas, Cuba, 1908, 1909.—Two stations, the second being designated as A, were occupied at this point. The main station is in southwest part of town in south corner of market square, 64 paces south-southwest of south corner of southeast wing of market, 45 feet (14 meters) northeast of entrance of small Cuban house marked 31. Marked by a wooden stake about 2 inches (5 cm.) in diameter projecting about an inch (2 cm.) out of ground and covered with a small pile of stones. The east gable of market is in true bearing 190° 53′.7. Station A is in an old field on the southern edge of town, about 300 yards (274 meters) south of a long tile-roofed building, 83 paces west of north corner of house in grove to the east, 70 paces southwest of south corner of house marked 2, 70 paces south-southwest of south corner of double house marked 4, and 90 paces northeast of small Cuban hut. A range of hills is visible east and south of the station one to two miles (2 to 3 kilometers), and the mountains to the south are seen in the distance. Marked by a round stake 2 inches (5 cm.) in diameter and 15 inches (28 cm.) long projecting about an inch (2 cm.) above ground and covered with a small pile of stones.

Plymouth, Montserrat, 1905.—About three-fourths mile (1.2 kilometers) northeast of the town, in extreme northeastern corner of Botanical Garden, 32.8 feet (10.00 meters) from stone gate post to west-southwest. Marked by a stone post 6 by 6 by 30 inches (15 by 15 by 76 cm.) set so as to project an inch (3 cm.) above the general surface, and lettered on top C.I. 1905, with a small hole in the center.

Pointe à Pitre, Guadeloupe, 1905.—Not far to the north of sugar factory, southeast of public square along the bay, just across the harbor from signal station and

ISLANDS, ATLANTIC OCEAN.

WEST INDIES—*continued.*

Pointe à Pitre, Guadeloupe, 1905—*continued.*
in logwood yard belonging to Mr. La Ronciere, on Rue Raspaie. It is 21.9 feet (6.67 meters) north of fence bounding the yard on south, and 67.5 feet (20.57 meters) from southwest corner of a stone and brick house a little north of east. Marked by a marble post 6 by 12 by 30 inches (15 by 30 by 75 cm.), the top lettered C.I.1905, with a hole at the center. The black ball on flagstaff belonging to Messrs. Gerard Freres & Company's sugar depot across the bay is in true bearing 83° 07′.7.

Port Castries, St. Lucia, 1905.—In Botanical Garden, along east side of harbor and just at northeastern corner of town, in northeastern corner of garden, about 75 feet (23 meters) south of walk on the north, 64 feet (19.5 meters) from walk on the east, and about 80 feet (24 meters) from walk on the south. Marked by two stones, the lower one being 12 by 12 by 15 inches (30 by 30 by 38 cm.) and the upper one about 12 by 12 by 8 inches (30 by 30 by 20 cm.). The top is lettered C.I.1905, a square hole being cut at the center to indicate precise point. The following true bearings were determined: Episcopal Church spire, 1° 15′.5; spire on the governor's house, 54° 53′.2.

Port of Spain, Trinidad, 1905, 1908.—In grounds of Agricultural Experiment Station, just west of extreme northwest corner of Queen's Park Savannah, and near end of the St. Clair Electric Car Line, near west gate of grounds, 65.2 feet (19.87 meters) from west fence and 58 feet (17.7 meters) from south edge of roadway passing superintendent's office. Marked by a hole in the top of a limestone post 6 by 6 by 30 inches (15 by 15 by 76 cm.) projecting 4 inches (10 cm.) above ground and lettered on top C.I.1905. The following true bearings were determined: flagpole on French Bishop's house, 320° 56′.1; spire on Mr. Stollmeyer's house, 306° 27′.4.

Roseau, Dominica, 1905.—Northeast of town, in northwestern corner of Botanical Garden, about 150 feet (46 meters) south of cricket house. Marked by two large stones, the lower one being about 6 by 12 by 18 inches (15 by 30 by 45 cm.) and the upper one about 12 by 12 by 8 inches (30 by 30 by 20 cm.) having its top face lettered C.I.1905, with a small hole at center. The spire of the Catholic Church is in true bearing 38° 56′.1.

Sagua la Grande, Cuba, 1908.—Northeast of town, about 600 yards (549 meters) beyond river and about 400 yards (366 meters) northeast of the Jesuit Church, in northeast end of rectangular field inclosed by hedges of cactus and mango trees, 136 feet (41 meters) east of a Cuban hut, 63.8 feet (19.4 meters) northwest of edge of road, 45 feet (14 meters) southwest of northeast edge of hedge, 40 feet (12 meters) southeast of northwest edge of hedge, and 40.5 feet (12.4 meters) north of innermost of the group of six mango trees. Marked by a marble slab about 2 by 4 by 21 inches (5 by 10 by 53 cm.) set flush with ground and lettered C.I.1908 (the center of station is the period after the I). The following true bearings were determined: cross on Sagua Church, 49° 33′.4; spire on Jesuit Church, 53° 10′.6.

St. George, Grenada, 1905.—On top of large hill known as Richmond Hill just back of town on summit of ridge which rises perhaps 400 feet (120 meters) above harbor, and the site of the prison and house of superintendent of prison, and about 250 feet (76 meters) south of Battery Hill. The station is about 150 feet (46 meters) due north of the house of the superintendent, 76.5 feet (23.32 meters) north-northeast of

ISLANDS, ATLANTIC OCEAN.

WEST INDIES—*continued.*

St. George, Grenada, 1905—*continued.*
northeast corner of stable, 48.3 feet (14.72 meters) northwest of burial lot, and 68.3 feet (20.82 meters) due west of a fiddlewood tree, which is east of road. Marked by a limestone post 6 by 6 by 24 inches (15 by 15 by 60 cm.) set so as to project about 1 inch (3 cm.) above general surface and having its top lettered C.I. 1905, with a drill hole at the center. The following true bearings were determined: signal station, 99° 13′.5; lighthouse, 100° 13′.6; Roman Catholic Church spire, 111° 58′.2.

St. Johns, Antigua, 1905.—Just east of town, in northwestern part of the Botanical Garden, on the west slope of a hill to the northwest of large sunken flower bed. Marked by a stone post 12 by 12 by 30 inches (30 by 30 by 76 cm.), the upper end being dressed down to about 6 inches (15 cm.) square, projecting about 2 inches (5 cm.) above general surface and lettered C.I.1905, with a small hole at center. The following true bearings were determined: signal station on Goat Hill, 101° 03′.1; signal station on Rat Hill, 109° 00′.6; north spire on Episcopal Church, 117° 33′.9.

San Fernando, Trinidad, 1905.—In the southwestern part of government pasture and public recreation grounds, about half a mile (800 meters) south of town, about 400 feet (122 meters) due west of armory, and about 250 feet (76 meters) from fence on west. Marked by a stone 6 by 6 by 36 inches (15 by 15 by 90 cm.) set so as to project about 3 inches (8 cm.) above surface of ground, and having the letters C.I.1905 painted in black on the top. The following true bearings were determined: Anglican Church spire, 238° 52′.9; Wesleyan Church spire, 243° 40′.7.

Sangre Grande, Trinidad, 1905.—About 1.5 miles (2.4 kilometers) south of town on a small hill, in the northwestern corner of the warden's yard near the public road, and 64.8 feet (19.75 meters) from the northwest corner of house. Marked by a limestone post 6 by 6 by 36 inches (15 by 15 by 91 cm.) set so as to project 3 inches (8 cm.) above general surface and lettered C.I.1905, with a small hole at the center.

San Juan, Porto Rico, 1905.—Station A is near North Base triangulation station of the U. S. Coast and Geodetic Survey, on opposite side of bay from San Juan and southwest of Morro Castle. The triangulation station was originally marked by the top of a glass bottle set in a cement pier 14 inches (36 cm.) in diameter at the top, placed about 60 feet (18 meters) from the shore line and having its top flush with general surface of ground. Station B is about 0.5 mile (0.8 kilometer) north of Catano and about 50 feet (15 meters) south of harbor signal tower. Station C is across the bay from San Juan about 1 mile (1.6 kilometers) north of Catano. It is at a point 54.5 feet (16.6 meters) northeast of the South Base triangulation station of the U. S. Coast and Geodetic Survey, on a line joining that station with the Morro lighthouse, and 57.2 feet (17.4 meters) west of a wire fence. The triangulation station is marked by a concrete post set flush with ground, over which a signal tower is erected. The following true bearings were determined: Morro lighthouse, 217° 09′.7; dome of jail, 255° 33′.2.

Santa Cruz, Cuba, 1909.—About one-half mile (0.8 kilometer) north of town, near the northern border of the marshy plain where it merges into a rising grass plain, about one-fourth mile (0.4 kilometer) west of the road leading from Calle Cimero to Santa Clara, one-fourth mile (0.4 kilometer) southwest of three small houses on the roadside, 100 paces south of a wire

ISLANDS, ATLANTIC OCEAN.

WEST INDIES—*continued.*

Santa Cruz, Cuba, 1909—*continued.*
fence, 125 paces southeast of south corner of this fence and 34 paces south of a road which branches off from main road a little north of guardhouse. Marked by intersection of two marks cut in top of post 2 by 3 by 18 inches (5 by 8 by 46 cm.). The cross on church to southeast is in true bearing 302° 25′.9.

Santiago, Cuba, 1909.—The first station was established in an open space on Raja Yoga grounds, about 100 feet (30 meters) southeast of road leading to dwelling house in grove to the northeast. Marked by a wooden stake projecting about 2 inches (5 cm.) out of ground. Iron flagpole on San Juan Hill bears 343° 29′.3. The main station was established about 125 yards (114 meters) southwest of monument to American soldiers on San Juan Hill, almost opposite cocoa palm grove at foot of hill, 31 feet (9 meters) northeast of intersection of two trenches that come together at an acute angle, 7 feet (2 meters) southeast of edge of trench running southwest and northeast. Marked by marble slab 8 by 2½ by 18 inches (20 by 6 by 46 cm.) projecting 2½ inches (6 cm.) out of ground and lettered on top C.I.1909 (the period after the I is center of station). The flagpole on Raja Yoga grounds, seen between the two most southerly cocoa palm trees, bears 154° 25′.2.

Scarborough, Tobago, 1905.—In the Botanical Garden on hill in northwestern part of garden to west of gardener's house and about 400 feet (122 meters) north and a little to west of his office, and 65.4 feet (19.93 meters) due north of the meteorological station. Marked by a stone post 6 by 6 by 30 inches (15 by 15 by 76 cm.) set so as to project about an inch (3 cm.) above the general surface and lettered on top C.I. 1905, with a small drill hole at the center. The following true bearings were determined: flagpole, old Fort and signal station, 311° 50′.8; flagstaff on courthouse, 335° 15′.4.

Scorpion Point, Culebra Island, Porto Rico, 1910.—Practically identical with that of the U. S. Coast and Geodetic Survey of 1903 and 1904, on line between the hydrographic signal "Scorp 2" and the triangulation station "Soldado," 7.9 meters from "Scorp 2," 3.6 meters from edge of bluff that stands at this place, the latter distance being measured in the direction of the "Soldado" triangulation station. The azimuth of the "Soldado" triangulation station as supplied by the U. S. Coast and Geodetic Survey is 314° 46′.5.

Vieques, Porto Rico, 1905, 1910.—The observations of 1905 were made at the old absolute magnetic observatory of the U. S. Coast and Geodetic Survey and in its immediate neighborhood. In 1910 observations were made in the new absolute house of the observatory on the regular magnetometer pier and the regular earth inductor pier, these two piers being designated as "New Absolute Observatory." Stations Nos. 1 and 2 are in line with the azimuth pier of the observatory and the right hand edge of Caballo Blanco Reef, which is 3.5 kilometers distant. Station No. 1 is 24.2 meters to the seaward of the azimuth pier. Station No. 2 is 26.4 meters to the landward of the azimuth pier. The tower of the lighthouse at Point Mulas is in true bearing from magnetometer pier 199° 20′.0; from station No. 1, 200° 23′.1; and from station No. 2, 198° 12′.5.

Yaguaramas, Cuba, 1908.—At the eastern end of an open square in the western part of town, 96.6 feet (29.4 meters) southwest of the entrance to Señor Luis Gomez's house, 55.8 and 99.8 feet (17.0 and 30.4

ISLANDS, ATLANTIC OCEAN.

WEST INDIES—*concluded.*

Yaguaramas, Cuba, 1908—*continued.*
meters) northwest from two large mango trees. Marked by intersection of two lines cut in top of a round wooden stake about 2 inches (5 cm.) in diameter and 15 inches (38 cm.) long, projecting an inch (2 cm.) above ground. The cross on Rosario Church at western end of square bears 82° 55′.7.

ISLANDS, PACIFIC OCEAN.

CAROLINE ISLANDS.

Yap Island, 1907.—The main station is on northwestern point of islet "Tarrang," near upper end of Tomil Bay, in Port Tomil, about 100 feet (30.5 meters) from the west and about 500 feet (152 meters) from the northwest shore lines of the islet, and 55 feet (16.8 meters) northwest of a large tree. Marked by a pine post 5½ by 5½ by 40 inches (14 by 14 by 100 cm.) set so as to project about 16 inches (40 cm.) above general surface; the lower part of post is tarred and the upper part painted white, with C.I. marked on one side and 1907 on the opposite side; the precise point is indicated by a cross cut in head of a brass screw set in center of top of post. The following true bearings were determined: beacon on Buray Hill, 88° 38′.2; chimney on west gable of long white cable building, 30° 00′.5. Two secondary stations were established, designated as Yap W and Yap E, the first 39.6 feet (12.08 meters) west of the main station, and the second 40.1 feet (12.23 meters) east of the main station; both secondary stations are in range with the principal station and the harbor beacon. From Yap E the windmill at cable station is in true bearing 44° 37′.2.

COOK ISLANDS.

Arutanga, Aitutaki Island, 1906.—South of road wharf leading from jetty to government offices, about 150 meters west-northwest of latter. There are three concrete survey blocks between land end of jetty and government offices; the station is 217 feet 10 inches (66.40 meters) distant from the center one of these. The true bearing of the center survey block is 290° 56′.4.

Avarua, Rarotonga Island, 1906.—On the beach and is peg No. 46 of the government survey of Rarotonga. Marked by a wooden post 4 by 4 inches (10 by 10 cm.) standing 12 inches (30 cm.) out of ground and marked with broad arrow on one face. The initial station of the government survey, marked by a concrete block in front of the government offices, is 164.8 meters distant and in true bearing 37° 49′.0.

POLYNESIA.

Fanning Island, 1905, 1906.—The main station is on a sandy plain east of cable station and near shore of lagoon, 105 feet (32.0 meters) west of rear of boat house on shore of lagoon and in line with quarters building at cable station. Marked by a redwood post 4 by 4 inches (10 by 10 cm.) in cross-section and 40 inches (102 cm.) in length, set so as to project about one foot above general surface; small hole in top of post marks the precise point. The following true bearings were determined: flagstaff at cable station-94° 16′; center rod of windmill, 102° 49′.3 A second, ary station was established in 1906 at a point about 100 feet (30 meters) true north 55° 52′ west of the main station.

FIJI ISLANDS.

Levuka, Ovalau Island, 1906.—Two stations were occupied on Ovalau Island. The principal one, designated as

FIJI ISLANDS—*continued.*

Levuka, Ovalau Island, 1906—*continued.*
Niakombi Point, is the astronomical station of the Hydrographic Survey of Ovalau, on Niakombi Point, at extremity of ridge running up to main divide, about 20 feet (6 meters) above high-water mark and east of cut made for main road on Ovalau. The native market is to the south about 60 feet (18 meters). The following true bearings were determined: beacon at entrance to harbor, 287° 35′.9; finial on Cathedral, 5° 55′.7. The second station, designated as Vagadace, is in the northeast corner of cricket field, near a stone wall along shore, and about 50 feet (15 meters) east of a road crossing cricket field. It is marked by a concrete block bearing the letters T.M.C.I.1906. The beacon light about a mile (1.6 kilometers) distant is in true bearing 328° 05′.7.

Nukulau Island, 1906.—At extreme southeast corner of cleared ground on which Government Indian Depot is situated, near beach and southwest of wharf; 12.7, 48.2, and 54.1 feet (3.9, 14.7, and 16.5 meters) respectively east, west of north, and north of west of three trees. The following true bearings were determined: beacon in Lancala harbor, 91° 25′.9; Armstrong's Point, 98° 25′.0; flagstaff on signal hill, 114° 27′.5; Devil's Thumb, 113° 28′.1.

Oinafa, Rotuma Island, 1906.—On beach in front of native village of Oinafa, opposite the islands Hana-mea-mea and Hanatin and approximately the observation point occupied by H. M. S. *Penguin* in 1896. North of a concrete building having a thatched roof, 148.5 feet (45.3 meters) from the northwest corner and 145.9 feet (44.5 meters) from the northeast corner. Marked by a concrete post 4.5 by 8 by 24 inches (12 by 20 by 60 cm.) standing 5 inches (13 cm.) out of the ground, lettered T.M.C.I.1906. The following true bearings were determined: Mount Soloroa, 87° 06′.3; Uea Island, 100° 31′.8; Hanatin Island, 185° 13′.7.

Suva, Viti Levu Island, 1906.—Observations were made at three points in Suva, viz., Base Station, Hospital Hill, and Dr. Klotz' Station. The Base Station is back of the government hospital, on a hill which falls away very steep on the west and south where it forms cliffs of coral capped with soapstone. The following true bearings were determined: lighthouse at entrance to harbor, 71° 19′.0; beacon at Lami River reef, 87° 47′.0; finial on lower lighthouse, 118° 52′.5; northeast edge of upper lighthouse, 134° 26′.3.

The Hospital Hill station is approximately the same as that occupied by H. M. S. *Waterwitch* in 1895 and 1896. It is on a spur 330 feet (101 meters) north of resident medical officer's house, about 95 feet (29 meters) west of Indian Hospital ward building, and about 120 feet (37 meters) above high-water mark. Marked by a wood post 6 by 6 by 24 inches (15 by 15 by 60 cm.) set flush with the ground and lettered T.M.C.I. The following true bearings were determined: beacon at Lami River reef, 91° 58′.8; finial on lower lighthouse, 124° 29′.3; northeast edge of upper lighthouse, 139° 54′.1.

The third station is approximately that occupied by Dr. Klotz in 1903. It is on the reserve fronting the harbor, about 70 feet (21 meters) and 100 feet (30 meters) from the southwest and southeast corners respectively of the cable station, and 68 feet (21 meters) from northwest corner of balcony of town hall. Marked by a wood post 6 by 6 by 24 inches (15 by 15 by 60 cm.) marked T.M.C.I., and set flush with the ground. The following true bearings were determined: beacon on Lami River reef, 138° 24′.5; finial on lower lighthouse, 150° 15′.0.

ISLANDS, PACIFIC OCEAN.

FIJI ISLANDS—*concluded.*

Suva Vou, Viti Levu Island, 1906.—About 2 miles (3 kilometers) from Suva on north shore of Suva Harbor and on a point called Suva Vou, identical with H. M. S. *Waterwitch* station of 1896 and was found marked by a concrete post standing about 18 inches (45 cm.) out of ground. The post is marked with an arrow and the year 1896. The lower lighthouse is in true bearing 129° 48′.6. A secondary station for dip observations, and designated as *Suva Vou B*, was established by the *Galilee* party about 75 feet (23 meters) northeast of above station.

Tilingitha Island, 1906.—Southwest of hill on a cocoanut plantation, on top of low bluff, about 25 feet (8 meters) from high-water mark and near landing-place from boat passage through mangrove swamp. Approximately the same as H. M. S. *Waterwitch* station of 1895. Marked by a cement post 4.5 by 8 by 24 inches (12 by 20 by 60 cm.) marked on top T.M.C.I. 1906.

HAWAII.

Sisal (*Honolulu Magnetic Observatory*), *Oahu Island*, 1905, 1907.—The observations were made on the magnetometer pier of the absolute house of the Coast and Geodetic Survey magnetic observatory, located at Sisal. In 1907 a tent station, A, was also occupied about 40 feet (12 meters) due true north of the absoluge observatory pier, in the observatory inclosure. A second tent station, B, was established about 60 feet (18 meters) southwest of the absolute observatory, in observatory inclosure. The various ship instruments were tested in 1907 at several other points in the observatory grounds.

LADRONE ISLANDS.

Guam, 1906.—Four stations were established, two at Orote Point and two at Cabras Island. The main station at Orote Point is east of the Point, on the south side of Apra harbor, and on a sand beach near base of high land on outer edge of vegetation. Marked by a cement post, set with its top somewhat above surface of ground. The following true bearings were determined: flagpole at Piti, 256° 39′.1; wireless telegraph pole, 266° 03′.6. Observations were also made at a point, designated Orote Secondary, about 30 feet (9 meters) east-northeast of the main station. The main station on Cabras Island is on the north side of Apra harbor, approximately 150 yards (140 meters) west of coal shed and about 30 feet (9 meters) from water. The following true bearings were determined: flagpole at cable station, 41° 09′.4; magnetic station at Orote Point, 71° 07′.0. Observations were also made at a point, designated Cabras Secondary, about 50 feet (15 meters) west of principal station.

MARQUESAS ISLANDS.

Nukahiva Island, 1907.—A number of stations were occupied and indicate local disturbance. Station 8 is on the site of the old Fort Collet, a small conspicuous rocky knoll on east side of Tai-o-hae, or Anna Maria Bay, and about 90 feet (27.5 meters) above sea-level. The point is about 40 feet (12 meters) northwest of a trail which leads up from the public trail to the harbor light, which is fixed to a pole 57.8 feet (17.63 meters) distant. Marked by a hole in the top of a pine post 3.5 by 5.5 by 33 inches (10 by 14 by 84 cm.) set one-half its length in the ground. The harbor light is in true bearing 0° 40′ west of south. Station 9 is near the northwest head of Tai-o-hae, or Anna Maria Bay, on land covered with a dense growth of tall brush, belonging to the government. This point is 27 feet (8.2 meters)

ISLANDS, PACIFIC OCEAN.

MARQUESAS ISLANDS—*concluded.*

Nukahiva Island, 1907—*continued.*
distant from and about 3 feet (1 meter) above high-water mark. The station is marked by a hole in top of a pine post 3.5 by 3.5 by 44 inches (9 by 9 by 110 cm.) projecting about 40 cm. above the ground. Three test stations were also established at points around 9; they are designated as 9_1, 9_2, and 9_3. The following true bearings were determined from 9: station 8, 278° 42′.3; harbor light pole, 279° 07′.6; northwest edge of Government House, 274° 00′.4. Two additional stations were placed on the line determined by station 8 and the basaltic cliff, which is in true bearing 60° 29′.1 west of south from 8. The first, designated as 8_1, is 40 feet (12.2 meters) west, and the second, 8_2, is 43 feet (13.1 meters) east along this line from the principal station.

MARSHALL ISLANDS.

Jaluit Island, 1906, 1907.—The main station of 1906 and 1907 is at American Town, about one and one-fourth miles (2 kilometers) south of the settlement, near the high-water mark and the shore end of the old railroad pier. Marked by a cement post bearing the letters C.I.1906, set with its top slightly above the surface of the ground. The following true bearings were determined: Company's flagpole, 204° 17′.2; hotel flagstaff, 197° 38′.4; beacon in lagoon, 183° 31′.8. Observations were also made in 1906 at a point, designated as Jaluit secondary, about 30 feet (9 meters) to the south and in range with station and Company's flagpole. Station Jaluit III of 1906 was established to test local disturbance about the position of swing in harbor, and is about 3 miles (5 kilometers) southwest of the principal station. Dip observations were made at a point, III Secondary, about 75 feet (22.9 meters) east of III. In 1907 a secondary station, designated Jaluit secondary 2, was established at a point 57.8 feet (17.62 meters) true south 17° 38′ west of the main station.

SAMOAN ISLANDS.

Apia, Upolu Island, 1905, 1906, 1907.—The observations made by G. Heimbrod in 1906 were at the first absolute house, on the spit of land called Mulinum, of the Samoa Observatory of the Imperial Academy of Sciences of Göttingen. The observations of 1906 by the officers of the *Galilee* were made at three points. One of these was the first absolute house of the Samoa Observatory. The second station, designated North Pier, was in the Observatory grounds about 50 feet (15 meters) north of the absolute house. The third station, designated as East Pier, was in the Observatory grounds about 50 feet (15 meters) east of the absolute house. The observations in 1907 were made at two stations. The first, designated stump, was near the north pier station of 1906, being about 10 feet (3 meters) northwest of the north pier. The second, designated as West Pier, was in the Observatory grounds about 41 feet (12.5 meters) west from west wall of new absolute house. The first absolute house of the Observatory was being rebuilt at the time of the 1907 work and it was not possible to observe in it.

SOCIETY ISLANDS.

Motu Uta, Tahiti Island, 1907.—Three stations were occupied near southeast corner of small island called Motu Uta in Papeete Harbor and designated as Motu Uta, Motu Uta 1, and Motu Uta 2. They are in line with flagstaff at Government Building. Motu Uta is the middle point, and stations 1 and 2 are 30

ISLANDS, PACIFIC OCEAN.

SOCIETY ISLANDS—*continued.*

Moto Uta, Tahiti Island, 1907—*continued.*
feet (9.1 meters) on each side, 2 being near the high-water mark. True bearing of Cathedral spire from Motu Uta, 296° 59′.0.

Papeete, Tahiti Island, 1906, 1907.—Within and near eastern corner of a tract of government land immediately south of the Botanical Garden, approximately 350 feet (106 meters) southeast of gardener's house in Botanical Garden, 175 feet (52 meters) northeast from windmill pump on government tract, 73 feet (22.2 meters) south-southeast from a large cocoanut tree standing near the fence, and approximately 50 feet (15 meters) from the fences to east and south. Marked by a hardwood post, lettered on top T.M.C.I. and having a copper tack at the center. In the reoccupation of 1907 a secondary station was also occupied 50 feet (15 meters) true north 32° 32′ west of the main station.

Point Fareute, Tahiti Island, 1906.—To east of site of old arsenal, close to beach and about 78 feet (24 meters) east of mouth of small stream, about 360 feet (110 meters) north of northeast corner of iron bridge across stream. Marked by a wooden post 4 by 8 inches (10 by 20 cm.) marked T.M.C.I. on two of its vertical faces.

Small Coral Island (Papeete Harbor), Tahiti Island, 1907.—On a small sandbar, about 100 feet (30 meters) long, and the same in width, rising about a foot (30 cm.) above high water, situated south of entrance to Papeete Harbor. Marked by a fir post about 3½ inches (9 cm.) square and 4 feet (1.2 meters) long,

ISLANDS, PACIFIC OCEAN.

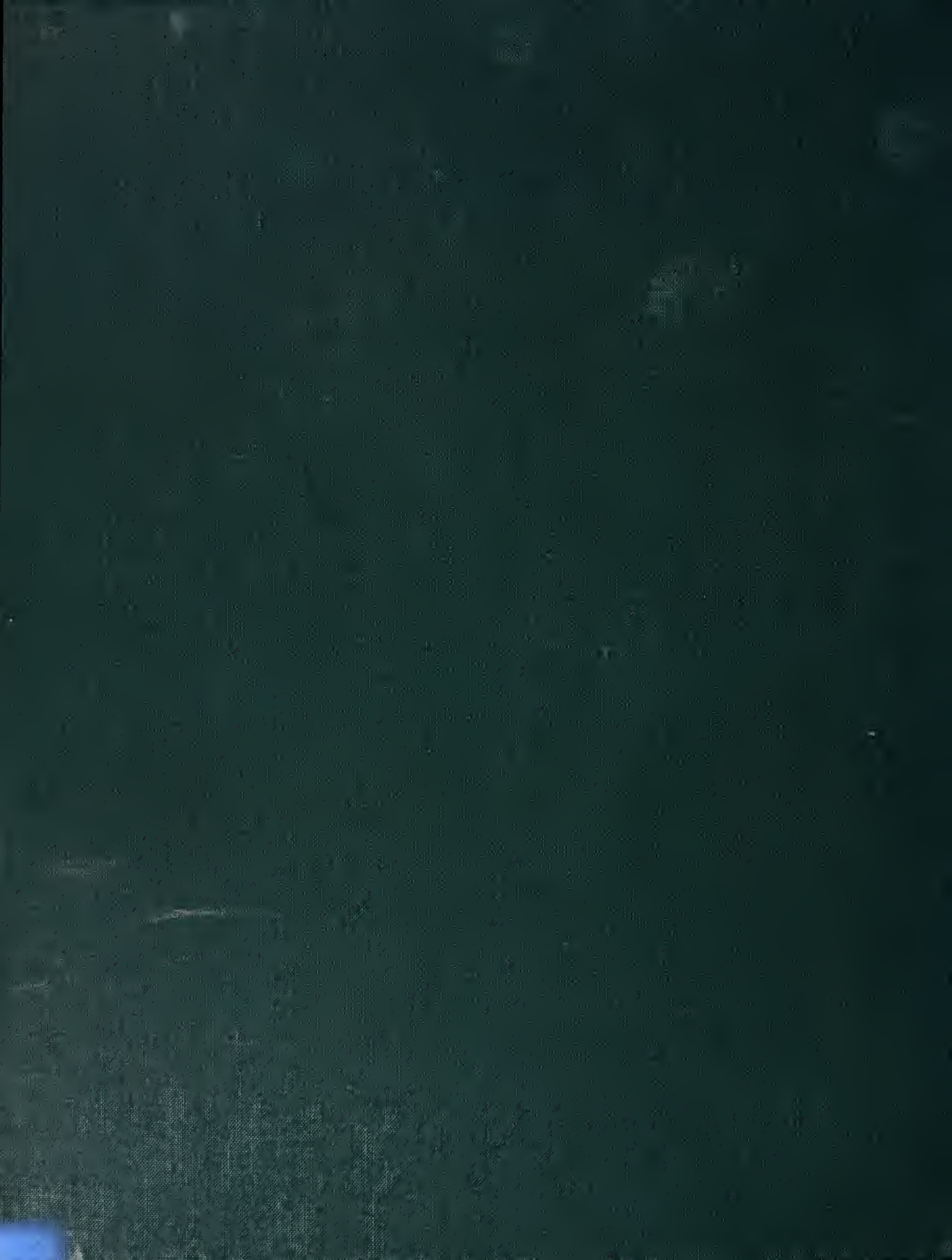
SOCIETY ISLANDS—*concluded.*

Small Coral Island (Papeete Harbor), 1907—*continued.*
sunk 1 foot (30 cm.) in the ground. The following true bearings were determined: Cathedral spire, 265° 57′.2; north obelisk, 267° 16′.8; south obelisk, 312° 04′.5. Two auxiliary stations, designated as 1 and 2, were occupied on the west and east sides of, and 30 feet (9.1 meters) distant from the principal station, in line with the Cathedral.

Vincennes Point, Moorea Island, 1906.—About 45 feet (13.7 meters) from high-water mark on east shore of Papetoai Bay, at Vincennes Point. Marked by a wooden post 4 by 8 inches (10 by 20 cm.) standing a foot (30 cm.) out of ground and bearing letters T.M.C.I. on two faces.

TUAMOTU ISLANDS.

Motu Rao, Rangiroa Island, 1906.—Near middle of small island of Motu Rao, in the lagoon of Rangiroa Island. The island is opposite and about 100 feet (30 meters) from the extreme east point of Fenna Rao Island, one of the Rangiroa group. Marked by a hardwood post 4 by 8 by 30 inches (10 by 20 by 76 cm.) set so as to project about 5 inches (13 cm.) above the ground, and bearing the letters T.M.C.I. on opposite sides.

Rotoava, Fakarava Island, 1906.—About one-fourth mile (0.4 kilometer) northwest of light at Rotoava wharf, and not far from high-water mark, 74 feet (22.6 meters) west from nearest of a group of old graves. Marked by a hardwood post. The light on wharf is in true beaaring 319° 36′.7.

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